ABSTRACTS OF NORTH AMERICAN GEOLOGY

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INTRODUCTION

Abstracts of North American Geology contains abstracts of technical papers and books and also citations of maps on the geology of North America including Greenland, the West Indies, as well as the State of Hawaii, Guam, and other island possessions of the United States. Articles of a general nature by North American authors are cited even though published in foreign journals, but those by foreign authors are included only if they appear in North American journals. Abstracts are prepared only of material that is believed to be generally available. Ordinarily abstracts are not published of material with small circulation (such as dissertations, open-file reports or memorandums) or of other papers presented orally at meetings.

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ABSTRACTS

Ackerman, J. *See* Hartman, Ronald R. 05726

00107 **Ackermann, Norbert L.; Sakthivadivel, R.** River-bed degradation below dams—Discussion [of paper 5335 by S. Komura and D. B. Simons, 1967]: Am. Soc. Civil Engineers Proc., v. 94, paper 5703, Jour. Hydraulics Div., no. HY 1, p. 336-340, illus., 1968.

Komura and Simons (ibid., v. 93, no. HY 4, p. 1-14, 1967) have derived an equation describing river-bed degradation which incorporated results of laboratory tests on armoring effects of nonuniform sediments; a final equilibrium profile was then computed for rivers below dams. Ackerman and Sakthivadivel question the applicability of several of the equations and mathematical operations, and consider the values used to introduce effects of channel armoring to be of doubtful reliability in predicting scour depths. They outline an alternate procedure to compute the equilibrium profile of a channel, based on field data representing the sediment transport function, and not including an armoring coefficient.—VMJ

05820 **Adam, D. P.** Pollen statistics from Osgood Swamp (California, U.S.A.) [abs.]: Rev. Palaeobotany and Palynology, v. 3, nos. 1-4, p. 14, 1967.

05450 **Adam, David P.** Nomogram for Mosimann's beta-compound multinomial correlation coefficient: Am. Jour. Sci., v. 265, no. 10, p. 907-908, illus., 1967.

A graph is presented on which the correlation to be expected by chance of two variables can be determined when variables are compared between samples of fixed sizes.—HRC

00038 **Agnew, A. F.** The geological profession and ground water: Ground Water, v. 6, no. 1, p. 5-9, 1968.

The locating and development of ground water is the province of the hydrogeologist, who is more than a ground-water geologist, for he deals with water in virtually every geologic situation. The hydrogeologist must possess the necessary background in the allied sciences and fluid mechanics, and should know something of the social science aspects of water decision-making. He must be able to work closely with the civil and sanitary engineers, and to make himself available to planners. In performing his work he has a responsibility to society, and this is equated with a responsibility to his profession.—*from* Author's abstract

05627 **Agterberg, F. P.** Computer techniques in geology: Earth-Sci. Rev., v. 3, no. 1, p. 47-77, illus., 1967.

A description of computer techniques based upon mathematical models is followed by a summary of recent developments in computer techniques for geological problems and a detailed description of some general, statistical techniques. It is shown that methods of trend analysis for a single variable should be modified when (a) the residuals are autocorrelated and (b) the computations are carried out by using transformed data for the variable. A technique of 2-dimensional power spectral analysis is employed for the quantitative description of periodicities in the grain arrangement in the Muskox Intrusion, and the trend of a multivariate system

is analyzed by using the multivariate Markhov scheme method.—*from* Author's summary

05597 **Ahr, Wayne Merrill.** Origin and paleoenvironment of some Cambrian algal reefs, Mason County area, Texas [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1985B, 1967.

Akimoto, S. *See* Ida, Y. 05812

05723 **Albers, John P.; Kleinhampl, Frank J.** Spatial relation of mineral deposits to Tertiary volcanic centers in Nevada [abs.]: Mining Eng., v. 19, no. 12, p. 41, 1967.

05662 **Albritton, Claude C., Jr.** (editor). Uniformity and simplicity—A symposium on the principle of the uniformity of nature: Geol. Soc. America Spec. Paper 89, 99 p., illus., tables, 1967.

The four essays in this volume were presented in a symposium at the general session of the 75th Annual Meeting of The Geological Society of America, held in New York City in November 1963. These essays treat uniformity from the viewpoints of a geologist, an historian of science, a paleontologist, and a philosopher of science.—MST

05663 **Albritton, Claude C., Jr.** Uniformity, the ambiguous principle, *in* Uniformity and simplicity—A symposium on the principle of the uniformity of nature: Geol. Soc. America Spec. Paper 89, p. 1–2, 1967.

The Principle of the Uniformity of Nature is widely acclaimed as the philosophical foundation upon which historical geology is built. Proponents of substantive uniformitarianism are inclined to interpret geologic history in terms of even, cyclic changes. Those who oppose substantive uniformity point out that the present condition of the Earth must be quite atypical of average conditions throughout geologic time. Advocates of methodological uniformitarianism seem to view the uniformity principle as a tautology: reconstructions of the past are determined by whatever we see occurring at present. Although no consensus was planned, or accomplished, these essays have common points of agreement. The trend of opinion seems to be the identification of methodologic uniformity as a geological formulation of the logical principle of simplicity.—MST

05903 **Algermissen, S. T.; Harding, Samuel T.** Note on the focal mechanism of the Parkfield, California earthquake of June 28, 1966: Seismol. Soc. America Bull., v. 57, no. 6, p. 1131–1141, illus., tables, 1967.

S-wave polarization studies of the Parkfield, California earthquake of June 28, 1966, indicate that a type II or double couple focal mechanism best fits the available data. The direction of greatest stress derived from the S-wave solution is in general agreement with results derived from geological evidence.—Authors' abstract

05620 **Altschuler, Z. S.; Berman, Sol; Cuttitta, Frank.** Rare earths in phosphorites—Geochemistry and potential recovery, *in* Anatomy of the western phosphate field—Intermountain Assoc. Geologists, 15th Ann. Field Conf. 1967: Salt Lake City, Utah, Intermountain Assoc. Geologists, p. 125–135, illus., tables, 1967.

Rare earths are only trace constituents of marine apatite, but as millions of tons of such apatite are dissolved annually to make phosphoric acid, an opportunity exists for greatly increasing rare-earth output as a byproduct of fertilizer production. New, quantitative analyses of rare earths in representative apatite concentrates reveal that the potential for byproduct rare earths equals current production. The rare-earth assemblage in marine apatite is unusual, showing depletion in cerium and relative enrichment in the heavier lanthanons, a favorable distribution for rare-earth technology and utilization. Uranium, thorium, and scandium may also be recoverable from phosphoric acid.—Authors' abstract

05860 **Amorós, J. L.** La energía de Madelung en los minerales—[Pt.] 1, Los polimorfos de la sílice [with English and Spanish abs.]: Estudios Geol., v. 22, nos. 1–2, p. 135–141, illus., tables, 1966 [1967].

The method of Bertaut (1953), modified by Templeton and Johnson (1961), has been applied to the study of the solid phases of silica. The Madelung constants of the different phases are very similar. The criterion of stability of the solid phases results when the energy density is calculated. It is confirmed that the structure of keatite needs further refinement.—Author's abstract

00044 **Amsden, Thomas W.; Klapper, Gilbert; Ormiston, A. R.** Lower Devonian limestone of post-Hunton age, Turkey Creek inlier, Marshall County, south-central Oklahoma: Am. Assoc. Petroleum Geologists Bull., v. 52, no. 1, p. 162–166, illus., 1968.

The Turkey Creek limestone is a thin distinctive lithostratigraphic unit known from only a single outcrop, and it has no correlatives in the region. It is sandwiched between strata of Late Ordovician and probable Late Devonian ages, and thus indicates that the Devonian of Oklahoma consists of thin units separated by unconformities.—WCC

Anand, Vera B. *See* Krizek, Raymond J. 00152

05795 **Anderson, Don L.** Latest information from seismic observations, Chap. 12 *in* The Earth's mantle (T. F. Gaskell, editor): London and New York, Academic Press, p. 355–420, illus., tables, 1967.

Some of the more important recent contributions of seismology to our understanding of the Earth's interior are discussed. Lateral heterogeneity of the crust and uppermost mantle is now well established by crustal refraction, local earthquake, and short-period surface wave studies. The most accurate surface wave data results from the determination of phase spectrums of successive passages of long-period waves past a single station. Developments in the field of free oscillations have been rapid since they were first observed in 1960. The damping of surface waves or of free oscillations can be interpreted in terms of the Earth's anelasticity. Body-wave travel time interpretations indicate the presence of a low-velocity layer and two major discontinuities in the upper mantle. Calculations for a low-velocity zone predict the existence there of a low-density zone.—JPF

05598 **Anderson, Franz Elmer.** Stratigraphy of late Pleistocene and Holocene sediments from the Strait of Juan de Fuca [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1985B, 1967.

05467 **Anderson, Keith E.; Kelley, Jack E.** Hydrogeology of the Soda Springs–Conda area, Idaho, *in* Anatomy of the western phosphate field—Intermountain Assoc. Geologists, 15th Ann. Field Conf. 1967: Salt Lake City, Utah, Intermountain Assoc. Geologists, p. 247–250, 1967.

Surface waters in the area are the Bear and Blackfoot Rivers and the Blackfoot River Reservoir. Part of the ground water in the Blackfoot Lava Field is the result of leakage from the reservoir. Most industrial ground-water development has been from the basalt aquifer. Industrial wells have individual yields which are a function of the thickness of basalt penetrated and the permeability of individual aquifers within it as well as the pump capacity. Where cinder beds or broken lava zones are encountered, well yields are high.—KAS

05644 **Angino, Ernest E.; Billings, Gale K.** Atomic absorption spectrometry in geology: Amsterdam and New York, Elsevier Publishing Co., (Methods in Geochemistry and Geophysics 7) 144 p., illus., tables, 1967.

The book is divided into two parts: theory and instrumentation, and methods and applications. Variations in shapes and widths of atomic spectral lines, and curvature of the calibration graph compose most of the chapter on theory. Light sources, sample vaporization, readout system, complete instruments, and methods of increasing sensitivity are examined under instrumentation. A chapter on interferences, listing specific elements, concludes the first part. Chapters on hydrogeochemistry, ore analysis, rock and mineral analysis, recent sediments, and isotopes and noble gases comprise the second part.—ESL

00143 **Anson, Abraham.** The use of color aerial photography in the reconnaissance of soils and rocks: Materials Research and Standards, v. 8, no. 2, p. 8–16, illus., 1968.

Several controlled tests are described—in the Coastal Plain, Bennettsville, S. C., and in the western desert near Phoenix, Ariz. Other work in color photography and some results are summarized. The Bennettsville test demonstrated that geologists never having visited the site could make an analysis of soil conditions with the use of 1:20,000 airphotos in color and in infrared color, with sparse generalized ground information. A highly skilled soils engineer performing interpretation on the Phoenix photography reached a valid conclusion as to the type of soils in the desert area when he was halfway through the study of the 1:40,000 color airphotos along with infrared. Technical questions regarding the falloff in color density with the use of wide angle lenses are answered. Color airphotos are another tool which can be used to assist soils engineers with reconnaissance studies.—*from* Author's abstract

05901 **Antoine, J. W.; Jones, B. R.** Geophysical studies of the continental slope, scarp, and basin, eastern Gulf of Mexico, *in* Symposium on the geological history of the Gulf of Mexico, Antillean–Caribbean region: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 268–277, illus., 1967.

New seismic reflection data correlate with previous data and show: the anticlinal structure along the northern section of the West Florida Escarpment can be followed south to 27°, the "scarp face reflector" can be followed south to the latitude of Dry Tortugas, the southern section becoming "hummocky", and the reflecting horizon is traceable as far south as 27°30′ N. South of this latitude the character of the reflections changes. This is interpreted to mean that the Tertiary section changes from predominantly clastic toward the northwest to mainly carbonate toward the southeast.—*from* Authors' abstract

Antoine, J. W. *See* Jones, B. R. 05943

05841 **Aoki, Ken-ichiro.** Alkaline and calc-alkaline basalts from Capulin Mountain, northeastern New Mexico, U.S.A.: Japanese Assoc. Mineralogists, Petrologists, Econ. Geologists Jour., v. 58, no. 4, p. 143–151, illus., tables, 1967.

In the Cenozoic volcanic rocks of the Raton area calc-alkaline basalts in Capulin Mtn. are of the same type as those in southwestern Japan (Aoki and Oji, 1966), derived from alkaline-olivine basalt magma contaminated by granitic material in the early stages of fractionation. New analyses of nine volcanic rock samples of the Raton area are tabulated; their mafic mineral assemblages are defined: Two samples from Capulin Mtn. are compared petrographically; the oldest, like the Raton basalt, is calc-alkaline; the youngest, erupted ca. 8,000 to 2,500 B.C., is alkaline-olivine basalt. It is concluded that the calc-alkaline basalt magma, developed at the top of the cupola prior to the extrusion of the alkaline basalt magma which assimilated granitic material, erupted before that digestion was completed. Successive alkaline eruptions formed the cinder cone.—GDC

Armbrustmacher, Theodore J. *See* Wrucke, Chester T. 05699

05752 **Armstrong, G. C.** An instrument for measuring planes and vectors in space: Jour. Sed. Petrology, v. 37, no. 4, p. 1241–1243, illus., 1967.

The instrument, developed for underground work involving measurement of cross-bedded units or minor tectonic structures, is built around a Brunton compass and is called a Stratameter.—RAC

05826 **Armstrong, Richard Lee; Hills, F. Allan.** Rubidium-strontium and potassium-argon geochronologic studies of mantled gneiss domes, Albion Range, southern Idaho, U.S.A.: Earth and Planetary Sci. Letters, v. 3, no. 2, p. 114–124, illus., tables, 1967.

The domes are composed of Precambrian crystalline complex overlain by metamorphosed Paleozoic sediments. A post kinematic adamellite stock intrudes

two of the domes. An isochron for the Precambrian rocks shows 2.46 b.y., and a good isochron for the adamellite is 30 m.y. K–Ar dates decrease from 77 m.y. to 30 m.y. with increasing stratigraphic depth in the Paleozoic rocks, perhaps due to progressive cooling as the rocks were exposed by uplift and erosion. K–Ar dates on the Precambrian rocks (45–134 m.y.) are greater than the overlying Paleozoic schists, and the reversal of the trend illustrates the extent to which factors other than temperature control the argon loss from micas.—*from* Authors' abstract

05633 **Auffenberg, Walter.** Further notes on fossil box turtles of Florida: Copeia 1967, no. 2, p. 319–325, illus., 1967.

Fossil box turtles from a single Rancholabrean site in Florida [four stratigraphic units of cave filling, Haile VIII A site, Alachua County] demonstrate that genetic interchange occurred between *Terrapene* populations formerly considered distinct at the species level. Genetic interchange is presumed on the basis of morphologic intermediacy of specimens originating from intermediate stratigraphic levels. All of the [15] specimens are referred to *Terrapene carolina*. Distributions of distinctive subspecies in the Florida Pleistocene are presumed to be ecologically controlled. Pleistocene environmental changes are reflected in the morphologic types of box turtles found in certain deposits.—Author's abstract

00120 **Bada, Jeffrey L.; Miller, Stanley L.** Ammonium ion concentration in the primitive ocean: Science, v. 159, no. 3813, p. 423–425, illus., table, 1968.

If ion exchange on clay minerals regulated the cations in the primitive ocean as it does in the present ocean, the pH would have been 8 and the K^+ concentration 0.01M. Since NH_4^+ and K^+ are similar in their clay-mineral equilibria, the maximum NH_4^+ concentration in the primitive ocean would also have been 0.01M. An estimate of the minimum NH_4^+ concentration is 1×10^{-3}M, based on the reversible deamination of aspartic acid and the assumption that aspartic acid is necessary for the origin of life. The rate of this nonenzymic deamination is rapid on the geological time scale.—Authors' abstract

05661 **Baird, Donald.** Age of fossil birds from the greensands of New Jersey: Auk, v. 84, no. 2, p. 260–262, 1967.

Several species of fossil birds from the glauconitic marls of New Jersey, originally described by O. C. Marsh (1870,1872) as Cretaceous in age, were redated as Eocene or late Paleocene by recent authors. Stratigraphic evidence presented here indicates that all birds from greensand marls of New Jersey are Late Cretaceous in age—most probably from the late Maestrichtian basal member of the Hornerstown Formation, a few from the middle Maestrichtian Navesink and New Egypt Formations; they are contemporaneous with avifaunas of the Lance and Hell Creek Formations of Wyoming and Montana. This redating strengthens the belief that most Cretaceous birds were of essentially modern types. Another bird, *Diatryma regens*, collected by Marsh (1894) from the Manasquan Formation, is shown to be middle rather than early Eocene in age.—VMJ

05949 **Bajorunas, L.; Duane, D. B.** Shifting offshore bars and harbor shoaling: Jour. Geophys. Research, v. 72, no. 24, p. 6195–6205, illus., 1967.

Movement of offshore bars in Lake Superior produces alternating accretion and erosion of the nearshore area and causes pulsation in littoral drift. Extensive formation of ice foots contributes to significant erosion in front of them. Harbor structures extending into the lake shift offshore bars, modify coastal currents, and cause shoaling in the lee. The pattern of harbor shoaling was established, and its relationship with the shifting of offshore bars and existing currents determined the pattern of deposition.—Authors' abstract

Baker, B. L. *See* Hodgson, G. W. 05848

05808 **Baker, C. H., Jr.; Price, Don.** (and others). Ground-water conditions in Utah, spring of 1967: Utah Div. Water Resources Coop. Inv. Rept. 5, 89 p., illus., tables, 1967.

The report contains information on well construction, ground-water withdrawals, water-level changes, and related changes in precipitation and streamflow. It also contains supplementary data related to ground-water use in some areas in the form of graphs showing chemical quality of water and maps of water-table configurations for those years or areas where applicable data are available and important to changing ground-water conditions. There are separate discussions of the most important areas of ground-water withdrawal for 1966.—Authors' introduction

05975 **Baksi, A. K.; York, D.; Watkins, N. D.** Age of the Steens Mountain geomagnetic polarity transition: Jour. Geophys. Research, v. 72, no. 24, p. 6299-6308, illus., tables, 1967.

The paleomagnetism of a series of lavas outcropping on Steens Mountain, southeastern Oregon, is consistent with a change in the geomagnetic field from reversed to normal polarity. Potassium-argon analyses of 19 specimens from 6 lavas indicate that this polarity change occurred at $t = 15.1 \pm 0.3$ m.y. Devitrified glass and slightly altered feldspars in one of the lavas have not adversely affected argon retention properties.—Authors' abstract

Bakun, W. H. *See* McEvilly, T. V. 05908

05946 **Ball, M.** Tectonic control of the configuration of the Bahama Banks, *in* Symposium on the geological history of the Gulf of Mexico, Antillean-Caribbean region: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 265-267, 1967.

The residual Bouguer anomaly map shows that density contrasts well below the floors of intraplatform straits and basins correlate with present platform topography. The basins and straits are negative, the platforms positive. Seismic data show similar-velocity units are displaced downward in the Florida Straits and Northwest Providence Channel. The deepest and highest velocity layer is at the top of the Upper Cretaceous rocks. Post Lower Cretaceous folding created topography which was filled in during Upper Cretaceous time, creating the conditions for the gravity anomalies. The Banks are from Cenozoic reef building, keeping in step with subsidence. The edges of this and other Banks coincides with regional structural features.—*from* Author's abstract

05746 **Ball, Mahlon M.; Shinn, Eugene A.; Stockman, Kenneth W.** The geologic effects of Hurricane Donna in south Florida: Jour. Geology, v. 75, no. 5, p. 583-597, illus., 1967.

During Hurricane Donna, storm currents moved great amounts of sand on the outside reefs and sand shoals of the reef tract, and formed far more coarse coral rubble than is formed by ordinary processes. The ebb of the storm tides left extensive deposits of layered lime mud stranded on tidal flats above normal high tide line, and carried muddy sediment and some sand off the platform edged reefs. Mounds of lime-rich muddy sediments resisted storm wave erosion, and were practically undamaged, in strong contrast to the extensive destruction of branching corals. Rocks derived from deposits similar to those formed by Hurricane Donna, and probably also representing catastrophic storms, are common in the geologic record.—ETR

Ballard, L. N. *See* Powell, H. E. 00036

Ballard, L. N. *See* Powell, H. E. 00037

05945 **Banks, J. E.** Geologic history of the Florida-Bahama platform, *in* Symposium on the geological history of the Gulf of Mexico, Antillean-Caribbean region: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 261-264, 1967.

This platform is the dominant structural feature in Florida; together with lesser structures, it forms the Florida embankment. The Florida embankment includes buried basement hills, transgressed embayments and fault troughs, the fringing but dominant carbonate platform, occasional deltas, and land ridges resulting from a drop in sea-level. Like all carbonate embankments, the one in Florida is anticlinal in cross-section, plunges seaward, has an exterior position on the continent, and

contains abundant carbonate detritus and sulphate evaporites derived from shallow water banks and lagoons but very few sediments deposited above sea level by streams. This embankment is similar to other structural units of the coastal province in having shallow and deep aquifers and deposits of solid, liquid, and gaseous hydrocarbons.—*from* Author's abstract

05596 **Bariss, Nicholas.** Geomorphological characteristics of loess terrain—A comparative study of five sample areas in the midwestern United States [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1981B, 1967.

Barla, G. *See* Kuo, John T. 00032

05459 **Barnett, Jack A.** Water resources of the Soda Springs area, Idaho, *in* Anatomy of the western phosphate field—Intermountain Assoc. Geologists, 15th Ann. Field Conf. 1967: Salt Lake City, Utah, Intermountain Assoc. Geologists, p. 251–253, 1967.

The Soda Springs area is drained by the Bear River and to a lesser extent by the Portneuf and Blackfoot Rivers. The flows of these surface streams are closely related to the movement and occurrence of ground water in the area. Ground water can be considered to be located in four basins. "Soda water" occurs in the area around Soda Springs.—KAS

00078 **Bassinger, B. G.** Marine magnetic study in the northeast Chukchi Sea: Jour. Geophys. Research, v. 73, no. 2, p. 683–687, illus., 1968.

Sea magnetometer operations were conducted in 1961 and 1962 off the northwest coast of Alaska. Tracklines provided adequate coverage for the delineation of prominent magnetic anomalies. A distinct change in character of the residual magnetic intensity contours occurs at about long 165°30′ W. Very little magnetic relief exists east of this longitude, but, to the west, a north–south trending magnetic feature was mapped with anomalies of up to 450 gammas. The feature appears to be more closely related to north–south structures associated with the Tigara uplift than to the east–west trends of the Colville geosyncline. The increase in magnetic intensity is interpreted as a shallowing of the basement surface that indicates a northern continuation of the Tigara uplift.—*from* Author's abstract

05648 **Bayrock, L. A.** Catastrophic advance of the Steele Glacier, Yukon, Canada: Research Council Alberta Occasional Pub. 3 (Contr. 377), 35 p., illus., tables, 1967.

The terminus portion of the Steele Glacier [on the north side of Mt. Steele, St. Elias Mountain Range] was studied between August 20 and August 24, 1966. It was found that the glacier was moving with an average velocity of 37 feet per 24 hours. The maximum rate of flow was 46 feet per 24 hours. Push moraines and the glacier were advancing mainly by slippage at the base. Dead ice from a previous advance was "squeezed" and incorporated into the moving glacier and was not overridden. At the toe, most of the motion of the glacier could be accounted for by shearing along the base.—Author's abstract

Beatty, Marvin T. *See* Cain, John M. 00154

Beck, A. E. *See* Judge, A. S. 05703

Becker, Alex. *See* Slankis, John A. 05713

Belt, Bill B. *See* Rodgers, Elton E. 00098

00092 **Bendixen, Thomas W.; Hill, R. D.; Schwartz, W. A.; Robeck, Gordon G.** Ridge and furrow liquid waste disposal in a northern latitude: Am. Soc. Civil Engineers Proc., v. 94, paper 5819, Jour. Sanitary Eng. Div., no. SA1, p. 147–157, illus., table, 1968.

The operation and performance of a municipal ridge and furrow liquid waste disposal system in use since 1959 [in Westby, Wis.] was monitored for a year and a half. One hundred and fifty thousand gallons a day of trickling filter effluent

are disposed into the soil via four 1-acre basins. A heavy stand of grass left unharvested over the winter apparently contributes to successful operation. The changes in infiltration rates and quality of the infiltrate with season and under various loading and operating conditions are examined as are companion field and indoor lysimeter studies comparing various design and operational factors that may influence infiltration protection of ground water.—Authors' abstract

05700 **Bennett, J. H.; Manuel, O. K.** On the origin of noble gas anomalies in the Canyon Diablo graphite: Earth and Planetary Sci. Letters, v. 3, no. 2, p. 95–100, tables, 1967.

Activation analysis of the Canyon Diablo graphite shows an iodine and uranium content of 337±35 ppm and 108±21 ppb respectively. The I-129—Xe-129 formation interval for the graphite is calculated and found to agree with the formation intervals reported for stony meteorites. During exposure to cosmic rays, the Abee enstatite chondrite is shown to be approximately 50 times more effective than Canyon Diablo in producing epithermal neutrons. The Kr-86 anomaly in Canyon Diablo graphite and other meteorites is compared to an unexplained Kr-86 excess reported in pile-irradiated chondrites.—Authors' abstract

Bennett, J. Michael. *See* Moore, Paul B. 00086

00141 **Benz, L. C.; Willis, W. O.; Sandoval, F. M.; Mickelson, R. H.** Soil water translocation in a high water table area: Water Resources Research, v. 4, no. 1, p. 95–101, illus., tables, 1968.

A field experiment was conducted to evaluate soil water, water table, and soil temperature relations in an area having a high water table, saline soil, and artesian water. The water table during winter lowered owing to upward migration of ground water toward the colder surface soil. However, the water content of the 2.7-meter soil profile increased in an amount of water exceeding that accountable by the drop in the water table, precipitation, and horizontal flow. The additional water was most likely contributed from the artesian aquifer underlying the area.—Authors' abstract

05590 **Berdanier, Charles Reese, Jr.** Genesis of some calimorphic soils in the New Jersey coastal plain [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1757B–1758B, 1967.

05894 **Berg, Eduard; Kubota, Susumu; Kienle, Jurgen.** Preliminary determination of crustal structure in the Katmai National Monument, Alaska: Seismol. Soc. America Bull., v. 57, no. 6, p. 1367–1392, illus., tables, 1967.

Seismic and gravity observations were carried out in the active volcanic area of Katmai in the summer of 1965. A determination of hypocenters has been attempted using S and P arrivals at three stations. A Poisson's ratio of 0.3 is found for the mantle under Katmai; this high value is probably due to the magma formation. The average depth to the M-discontinuity from seismic data in the same area is 38 km and 32 km under Kodiak. Using Woollard's relation between Bouguer anomaly and depth to the M-discontinuity, a small mountain root under the volcanoes with a depth of 34 km was found dipping gently up to 31 km on the NW side. The active volcanic cones are located along an uplift block, associated with a 35-mgal Bouguer anomaly. The Bouguer anomaly contour map for the Alaska Peninsula is given and an interpretation attempted.—*from* Authors' abstract

05852 **Berg, Henry C.; Cobb, Edward H.** Metalliferous lode deposits of Alaska: U.S. Geol. Survey Bull. 1246, 254 p., illus., 1967.

This report summarizes from reports of Federal and State agencies published before August 31, 1965, the geology of Alaska's metal-bearing lodes, including their structural or stratigraphic control, host rock, mode of origin, kinds of minerals, grade, past production, and extent of exploration. In addition, the lists of mineral occurrences that accompany the 35 mineral-deposit location maps constitute an inventory of the State's known lodes. A total of 692 localities where metalliferous deposits have been found are shown on the maps. The localities include 1,739 mines,

prospects, and reported occurrences, of which 821 are described individually or otherwise cited in the text.—HCB

00071 **Bergstrom, Robert E.** Disposal of wastes—Scientific and administrative considerations: Illinois Geol. Survey Environmental Geology Notes 20, 12 p., illus., 1968.

This address was given at the Midwest Ground-Water Conference, Cincinnati, Ohio, October 1967, which was concerned with waste management as it relates to ground water. Principal sources of contamination discussed are: land fills and dumps, radioactive-waste disposal, sewage treatment and waste storage ponds, disposal wells, and sewage-storm water tunnels. Examples from Illinois are illustrated by maps showing potentially favorable areas for disposal. It is concluded that ground-water geologists should promote sites for disposal where there are natural safeguards, help acquire useful data on the physical system and criteria for assessing the protection, and delve into investigations pertinent to waste management problems.—ESL

Berman, Sol. *See* Altschuler, Z. S. 05620

00130 **Berner, Robert A.** Calcium carbonate concretions formed by the decomposition of organic matter: Science, v. 159, no. 3811, p. 195–197, illus., table, 1968.

Bacterial decomposition of butterfish and smelts in small sealed jars containing seawater and other solutions, for periods ranging from 65–205 days, results in a large increase in concentrations of dissolved bicarbonate, carbonate, and ammonia (plus volatile amines). Accompanying this is a rise in pH and the precipitation of Ca^{++} from solution. The Ca^{++} is not precipitated as $CaCO_3$ but instead as a mixture of calcium fatty acid salts or soaps with from 14–18 carbon atoms. This can be explained by the thermodynamic instability of $CaCO_3$ relative to Ca soaps in the presence of excess free fatty acid. It is suggested that some ancient $CaCO_3$ concretions, especially those enclosing fossils of soft-bodied organisms, may have formed rapidly after death in the form of natural Ca soap (adipocere) which was later converted to $CaCO_3$.—Author's abstract

Billings, G. K. *See* Klovan, J. E. 05881

Billings, Gale K. *See* Angino, Ernest E. 05644

05898 **Billings, Gale K.; Williams, H. H.** Distribution of chlorine in terrestrial rocks (a discussion): Geochim. et Cosmochim. Acta, v. 31, no. 11, p. 2247, 1967.

Examination of the water-soluble Cl content of surface and subsurface indicates: (1) ground water leaching seriously reduces the Cl content of shales; (2) the average Cl content of shales may be as much as 14 times the average normally proposed; and (3) most of the Cl in shales is water soluble.—Authors' abstract

Bingham, J. W. *See* Richardson, Donald. 00075

00083 **Birch, Francis.** Thermal expansion at high pressures: Jour. Geophys. Research, v. 73, no. 2, p. 817–819, 1968.

Estimates of the coefficient of thermal expansion (α), at pressures up to several megabars, are needed for various geophysical calculations. A relationship given earlier (1939,1952) without detailed derivation is clarified here. It is shown to be fairly common to a family of equations of state, to which most of those in current use belong. The expression $\alpha/\alpha_o = K_o/K$ may be the most dependable relationship for geophysical purposes and also the most useful, as K (the isothermal bulk modulus) can be obtained from seismic velocities.—DBV

05767 **Bishop, Charles C.; Chapman, Rodger H.** (compilers). Bouguer gravity map of California—Santa Cruz sheet: [San Francisco, Calif.] California Div. Mines and Geology, scale 1:250,000, separate text, 1967.

A complex assemblage of rock units (pre-Cretaceous-Recent) is found within the Santa Cruz map area; the San Andreas fault is probably the most significant of the fault zones. Bouguer gravity values decrease from a maximum of about +30 mgals near the coast to a minimum of -70 mgals on the western edge of the San Joaquin Valley. The area between the east side of the Coast Ranges and the west side of the San Joaquin Valley is marked by a major northwest-trending gravity minimum; northeast of this area and approximately parallel to it is a relatively high anomaly which extends the entire length of the San Joaquin Valley and Sacramento Valley to the northwest. The San Andreas fault zone is marked throughout much of its length by steep gravity gradients. Several other gravity highs and lows are described.—MCM

00065 **Bishop, William F.** Petrology of Upper Smackover Limestone in North Haynesville field, Claiborne Parish, Louisiana: Am. Assoc. Petroleum Geologists Bull., v. 52, no. 1, p. 92–128, illus., table, 1968.

The upper Smackover Limestone consists of an upper transitional facies, then the reservoir facies composed of oolites and superficially coated pellets with spar cement and primary intergranular porosity; the mixed facies composed of subequal quantities of all grain types with spar cement and mud matrix; and the pellet-mud facies composed of pellets in a mud matrix which commonly is dolomitized. Pellet-mud was deposited in warm, quiet, shallow, probably hypersaline water. Subsequently slight differential uplift caused turbulence in local areas, where the mixed facies was deposited. Later regional uplift and regression brought about conditions favorable for extensive oolite accretion, resulting in reservoir-facies deposition. Continued uplift of land areas on the north supplied increasing amounts of terrigenous detritus to the transition facies, and carbonate deposition eventually ceased.—*from* Author's abstract

00073 **Bjorklund, L. J.; Robinson, G. B., Jr.** Ground-water resources of the Sevier River basin between Yuba Dam and Leamington Canyon, Utah: U.S. Geol. Survey Water-Supply Paper 1848, 79 p., illus., tables, geol. map, 1968.

Fault-alined sinkholes in the alluvium of Scipio, Little, and Mills Valleys, indicate solution channels in the North Horn Formation and Flagstone Limestone of Upper Cretaceous and Tertiary age. The faults trend NNE across Scipio Valley toward large springs in Mills Valley. In Scipio Valley an abrupt change in water-table level of more than 200 feet is caused by drainage from a shallow to a deeper reservoir through conduits beneath the sinkholes. Most of the ground water moves toward the Sevier River, some by surface flow; seepage from the surface reservoir above Yuba Dam is not related to Molten and Blue Springs, but may be to Chase Springs. Amounts of discharge in 1963 are given for various springs and seeps; chemical analyses show some fresh water and some saline but suitable for irrigation.—GDC

05810 **Black, D. I.** Cosmic ray effects and faunal extinctions at geomagnetic field reversals: Earth and Planetary Sci. Letters, v. 3, no. 3, p. 225–236, illus., tables, 1967.

Studies of deep-sea cores show that the last reversal of the Earth's magnetic field and the extinction of a group of radiolarian species occurred simultaneously. The evidence suggests a possible causal relation. Some effects on the Earth and atmosphere at a field reversal are quantitatively considered, but it is shown that no direct or indirect radiation effect from cosmic rays or solar flares, nor any solar wind effect can be a significant factor in the extinction of the species. The grounds for believing in a causal relation between magnetic and faunal changes are examined.—Author's abstract

05799 **Black, Jack.** Handbook for underwater prospectors: Tarzana, Calif., Ames Publishing Co., 97 p., illus., 1965 [1967].

This is designed for those who want to make a hobby of diving for gold. Subjects covered are: what is gold?, is there any left?, gold panning and basic tools, diving for prospectors, the underwater dredge, other tools, basic theory of placer geology, business of prospecting, how to recognize gold, final concentration methods, tips on dredging, electronic aids, beach placer possibilities, how to get rich in underwater

prospecting, the Mother Lode, gold diving locations in California and Arizona, and the law and the prospector. State maps show location of gold placer areas.—ESL

Blair, R. G. *See* Wallace, S. R. 05716

00051 **Blake, Wilson.** Finite element model study of slope modification at the Kimberly Pit [abs.]: Mining Eng., v. 20, no. 1, p. 91, 1968.

05751 **Blatt, Harvey.** Provenance determinations and recycling of sediments: Jour. Sed. Petrology, v. 37, no. 4, p. 1031–1044, illus., table, 1967.

In contrast to mineral relationships in igneous and metamorphic rocks, mineral assemblages in sedimentary rock are invariably not in equilibrium. For this reason problems of interpretation in sedimentary petrology are more difficult than those in igneous and metamorphic petrology. Interpretations of provenance are unfortunately generally made without fundamental knowledge of mineral suites of common soils, and of igneous and metamorphic source rocks. Criteria for distinguishing recycled mineral particles, and methods for weighing probable proportions of contributed sediment from different source terranes are needed. RAC

05738 **Blenkinsop, J.; Slawson, W. F.** Geophysical evidence of the Zuni Lineament: Earth and Planetary Sci. Letters, v. 3, no. 1, p. 75–80, illus., 1967.

This paper presents some geophysical evidence bearing on the nature of the Zuni Lineament in central New Mexico. Reported are some new lead isotope measurements, the results of a geomagnetic depth-sounding survey, and the integration of these with seismic data of Sandford. It is suggested that the Zuni Lineament may have been a major Precambrian feature of this area, but that it presently constitutes only a shallow zone of weakness. The zone does not appear to extend below a 20 km depth. Isotopically, the southeastern extension of the zone is not nearly so clear-cut as it is in the Rio Grande region.—Authors' abstract

Block, D. A. *See* Kelly, T. E. 05763

05599 **Blount, Donald Neal.** Geology of the Chiantla quadrangle, Guatemala [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1968B, 1967.

05785 **Blumer, Max.** Equilibria and nonequilibria in organic geochemistry, [Chap.] 15 *in* Equilibrium concepts in natural water systems—Am. Chem. Soc., 151st Ann. Mtg., Pittsburgh, 1966, Div. Water, Air and Waste Chemistry Symposium: Washington, D.C., Am. Chem. Soc. (Adv. Chemistry Ser. 67), p. 312–318, illus., 1967.

Carbon compounds may have existed at or near thermodynamic equilibrium on the early, prebiological earth. The activity of organisms has converted most carbon in the earth's crust into thermodynamically unstable but long-lived compounds. During diagenesis a gradual, irreversible approach towards equilibrium occurs, but complete equilibrium between all components is not reached within time spans approaching the age of the earth. This does not preclude the participation of many metastable fossil organic compounds in reversible equilibria. Further study of these may lead to a tool for investigating chemical environments in the past.—Author's abstract

05695 **Boettcher, A. L.; Piwinskii, A. J.; Knowles, C. R.** Zoned potash feldspars from the Rainy Creek complex near Libby, Montana: Earth and Planetary Sci. Letters, v. 3, no. 1, p. 8–10, illus., table, 1967.

The Rainy Creek igneous complex consists of metamorphic rocks surrounded by Precambrian limestones, dolomites, and argillites which have been fenitized, yielding a syenite-composition rock enriched in K, Fe^{3+}, Ti, and possibly other minor elements. Some of the alkaline rocks could have originated by rheomorphism or palingenesis of rest fenites. Porphyritic with vitreous feldspar phenocrysts which are oscillatory-zoned are in the alkaline rocks and are in glomeroporphyritic association. Electron probe analysis of the zones shows that they cannot be

attributed to variations in the proportions of K, Ca, or Fe, but rather to large variations in the celsian contents.—HRC

05745 **Boettcher, A. L.** The Rainy Creek alkaline–ultramafic igneous complex near Libby, Montana—[Pt.] 1, Ultramafic rocks and fenite: Jour. Geology, v. 75, no. 5, p. 526–553, illus., tables, geol. map, 1967.

This domical complex, 2.5 miles across and 94 m.y. old, is the world's chief source of vermiculite. The complex intrudes a syncline in the Precambrian Belt Series. Syenite, nepheline syenite, and fenite are associated with the ultramafic rocks, which comprise a central zone of biotite pyroxenite and biotitite encircled by a ring dike of magnetite pyroxenite enriched in apatite. The ultramafic rocks are products of fractional crystallization of a common parent magma, possibly a pyroxenite enriched in water, from which the biotite pyroxenite and biotitite formed at high T, P_{water} and $f_{dioxide}$. Carbonate-bearing xenolithic nodules are present in the biotitite core, and carbonatite, alkalic rocks, or both variants may be present at depth. Chemical, modal, mineralogic, isotopic, and geophysical data are given.—BFL

05917 **Bofinger, V. M.; Compston, W.** A reassessment of the age of the Hamilton Group, New York and Pennsylvania, and the role of inherited radiogenic Sr-87: Geochim. et Cosmochim. Acta, v. 31, no. 12, p. 2353–2359, illus., 1967.

Statistical reassessment of the Rb–Sr data of Whitney and Hurley (1964) for the Middle Devonian Hamilton Group, New York and Pennsylvania, shows that the age can be more adequately represented by two parallel isochrons instead of the conventional one. Pooling of these two isochrons results in an apparent age of 384±9 m.y. for the Hamilton Group (using λ Rb-87 = 1.47×10^{-11}/yr), with the possibility that this value could be reduced to 377±11 m.y. These estimates fall within the presently suggested limits for the age of the Devonian. On the basis of these results there is no evidence to suggest that in general the application of total rock Rb–Sr age measurement techniques to argillaceous sediments yields results in excess of the true age of sedimentation.—Authors' abstract

05814 **Bogard, D. D.; Burnett, D. S.; Eberhardt, P.; Wasserburg, G. J.** ^{87}Rb–^{87}Sr isochron and ^{40}K–^{40}Ar ages of the Norton County achondrite: Earth and Planetary Sci. Letters, v. 3, no. 3, p. 179–189, illus., tables, 1967.

Analysis of Norton County, Kans., achondrite yielded Rb/Sr ratios ranging from 0.15 to 2.3 and permitted determination of an isochron with high precision. The Rb and Sr concentrations were found to be as low as approximately 0.16 ppm, and give an age of $4.7\pm0.1\times10^9$ yr for $\lambda = 1.39\times10^{-11}yr^{-1}$. K–40/Ar–40 ages on samples containing 42, 53, and 107 ppm gave K ages of 4.2–4.5×10^9 yr which are compatible with the Rb–Sr age. The K appears to be concentrated in alkali feldspar grains of about 5–50 microns. No evidence of element redistribution was found for Norton County as indicated by the consistency of the Rb–Sr and K–Ar results.—*from* Authors' abstract

05640 **Bohn, Dave.** Glacier Bay—The land and the silence: San Francisco, Calif., Sierra Club, 165 p., illus., 1967.

Glacier Bay National Monument, Alaska, was photographed over a period of five years by the author. The text accompanying these photographs tells of the early explorations, including notes from diaries and reports, and of advance and retreat of the many glaciers. The area described is a unique wilderness park, and it is the hope of the publishers that it may be so retained.—ESL

00082 **Bollinger, G. A.** Determination of earthquake fault parameters from long-period P waves: Jour. Geophys. Research, v. 73, no. 2, p. 785–807, illus., table, 1968.

The theory for propagating earthquake sources predicts a "Doppler-type" effect in the time duration of the radiated body wave pulses. With constant fracture velocity, the duration of these pulses is directly related to fault length but has different spatial patterns of variation for unilateral and bilateral faulting. Various pulse forms are postulated whose time history is controlled by the fault parameters of length and fracture velocity, and are convolved with the impulse response of

a standard crust–seismograph system to yield theoretical P-wave seismograms, establishing a relation between the radiated pulse durations and durations observed at the surface. This is used to correct the times of observed long-period P waves to recover the original time-duration radiation pattern. The fault length and fracture velocity that best fit this observed pattern can then be found.—*from* Author's abstract

05804 **Bonar, Robert B.** Coal: British Columbia Dept. Mines and Petroleum Resources Ann. Rept. 1966, p. 374–393, tables, 1967.

The gross output of coal in British Columbia for 1966 of 1,088,133 short tons was a decrease of 1.64 percent from 1965. The Vancouver Island production of 17,479 tons was a decrease of 58.7 percent; there was no operation in the Nicola–Princeton District; the Northern District produced 11,975 tons, an increase of 102.9 percent; and the East Kootenay District 1,058,679 tons, an increase of 0.02 percent. Notes on the coal mines discuss some mining geology.—GDC

05651 **Bonham-Carter, G. F.** FORTRAN IV program for Q-mode cluster analysis of nonquantitative data using IBM 7090/7094 computers: Kansas Geol. Survey Computer Contr. 17, 28 p., illus., tables, 1967.

CLUST3 is an IBM 7090/7094 FORTRAN IV program for classifying objects into groups based on a large number of nonquantitative characters considered simultaneously. Either Sokal and Michener's coefficient or Jaccard's coefficient may be used as a measure of similarity. The mean expected value of similarity also is calculated. The weighted or unweighted pair-group method may be used for clustering and results may be displayed automatically by setting a plotting option for drawing a dendrogram. A version for the IBM 360/67 is also obtainable from the Kansas Geological Survey.—Author's abstract

05930 **Bonham-Carter, G. F.; Sutherland, Alex J.** Diffusion and settling of sediments at river mouths—A computer simulation model, *in* Symposium on the geological history of the Gulf of Mexico, Antillean-Caribbean region: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 326–338, illus., tables, 1967.

The rate of sediment accumulation at any point in front of a channel mouth is governed by water and sediment discharge, sediment grain size distribution, sediment density, porosity of resulting sediment, width and depth of river channel, and basin geometry. A plane jet model is used for determining the velocity field and the rates of sediment diffusion. By adjusting the input parameters, a variety of "delta" deposits may be created. The shape and forset slope of the delta fan is found to be closely controlled by grain size and discharge. By allowing the model to respond dynamically to the buildup of sediment at the channel mouth, a distributary mouth bar and submerged levees can be formed.—*from* Authors' abstract

Boshkov, Stefan H. *See* Kuo, John T. 00032

05784 **Boström, K.** Some pH-controlling redox reactions in natural waters, [Chap.] 14 *in* Equilibrium concepts in natural water systems—Am. Chem. Soc., 151st Ann. Mtg., Pittsburgh, 1966, Div. Water Air and Waste Chemistry Symposium: Washington, D.C., Am. Chem. Soc. (Adv. Chemistry Ser. 67), p. 286–311, illus., tables, 1967.

Using stoichiometric model systems, it can be shown that some naturally occurring redox processes have a pronounced pH-controlling action, even in the presence of substances that act as buffers. High pH values can be reached particularly in systems where higher metal oxides act as oxidizers whereas an acid condition often develops when free oxygen is the oxidizer. However, in most natural systems carbonates and silicates have a more pronounced pH controlling effect than redox processes.—Author's abstract

Boudreaux, Joseph E. *See* Hay, William W. 05923

Bourn, Oscar B. *See* Nygreen, Paul W. 05803

05832 **Bowling, Leslie.** Why and whither G.C.A.G.S.: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. XVII–XIX, 1967.

The limitations of four AAPG-sponsored Gulf Coast regional meetings from 1946–49 resulted in the formation of the Gulf Coast Association of Geological Societies to hold meetings and facilitate publications; the first meeting was held in 1951. Growing pains resulted, but they are now healed. The GCAGS became an official section of the AAPG in 1967 and this needs only final ratification. Henceforth it is anticipated that the GCAGS will be an accumulation of dates and statistics, but only if it maintains its autonomy and political freedom.—*from* Author's abstract

00105 **Bradfield, H. H.** Stratigraphy of deeper Marietta basin in Oklahoma and Texas [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 52, no. 1, p. 193–194, 1968; Shale Shaker, v. 18, no. 5, p. 97, 1968.

00043 **Branson, Carl C.** Contribution of S. W. Lowman to Oklahoma geology: Oklahoma Geology Notes, v. 28, no. 1, p. 32, 1968.

05632 **Brattstrom, Bayard H.** A succession of Pliocene and Pleistocene snake faunas from the high plains of the United States: Copeia 1967, no. 1, p. 188–202, illus., tables, 1967.

Over 11,000 skeletal elements of snakes from lower Pliocene to Recent fossil deposits from Kansas and adjacent areas were studied. Each local fauna is relatively distinct; glacial and interglacial faunas differ in kind, number, and size of snakes. Many but not all of the Pliocene and interglacial snake species occur in Kansas today. The greatest overlap of ranges of all the species represented in the fossil deposits occurs today in southwestern Texas, in the Balconian Biotic Province. In contrast to the mammal fauna and to other herpetofaunas, the snake faunas from the High Plains have no extinct forms in the Pleistocene deposits, and indicate that most genera and species of Recent snakes go back almost unchanged to at least upper and in some cases lower Pliocene.—*from* Author's abstract

Bridges, J. H. *See* Richards, R. W. 05469

05750 **Briggs, Garrett; Cline, L. M.** Paleocurrents and source areas of late Paleozoic sediments of the Ouachita Mountains, southeastern Oklahoma: Jour. Sed. Petrology, v. 37, no. 4, p. 985–1000, illus., 1967.

Late Mississippian and early Pennsylvanian flysch sediments of the Ouachita foldbelt of southeastern Oklahoma include turbidites. Direction of transport for the Jackfork, Johns Valley, and lower Atoka formations was westward down the axis of the syncline. In the Arkoma basin, sediment transport was southward across the basin. The Ouachita geosyncline derived its sediments from sources along its margins. Some sands were derived from the northern craton. Turbidity flow from lateral sources was the dominant transport mechanism. Some transport parallel to the axis by marine currents is probable. Criteria for recognition of turbidity flows include graded bedding, convolute bedding, and flute, bounce, prod and groove molds.—RAC

05815 **British Columbia Minister of Mines.** (and Petroleum Resources). Petroleum and natural gas: British Columbia Dept. Mines and Petroleum Resources Ann. Rept. 1966, p. 277–354, illus., tables, 1967.

Summarized here are the production of petroleum and natural gas, exploration (with significant discoveries), reserves, tabulated reservoir data, and availability of well records and oil- and gas-field reports for 1966 in British Columbia. The majority of drilling was carried out in Mesozoic horizons.—GDC

05816 **British Columbia Minister of Mines.** (and Petroleum Resources). Structural materials and industrial minerals: British Columbia Dept. Mines and Petroleum Resources Ann. Rept. 1966, p. 259–276, illus., tables, 1967.

Very briefly reported here are the 1966 development and production in various properties of asbestos, barite, building stone, cement, clay and shale, diatomite,

dolomite, fluorite, gypsum, limestone, magnesite, marl, phosphate, pozzolan, sand and gravel, silica, and talc. In a few cases some geology is reviewed or mentioned; analyses are given for seven limestone samples in the Cowichan Lake–Port Renfrew area; and data on sand and gravel production are presented in a table.—GDC

05817 **British Columbia Minister of Mines.** (and Petroleum Resources). Lode metals: British Columbia Dept. Mines and Petroleum Resources Ann. Rept. 1966, p. 1–252, illus., tables, 1967.

In this section of the Annual Report, a general review of mining and exploration is followed by notes on the various metal mines, including a number of individual summaries of the geology by geologists, which are not separately cited in this bibliography, and geologic sketch maps. Out of the 265 properties enumerated, geologic mapping was done on 155, surface work on 139, underground on 21, drilling on 143, geophysical surveys were made on 120, and geochemical surveys on 112. The geological, geophysical, and geochemical reports credited for assessment during the year, and filed in the Victoria office are listed.—GDC

Brock, M. R. *See* Zartman, R. E. 05446

Broecker, Wallace S. *See* Ku, Teh-Lung. 05961

05845 **Brooks, Elwood R.** Multiple metamorphism along the Grenville Front, north of Georgian Bay, Ontario: Geol. Soc. America Bull., v. 78, no. 10, p. 1267–1279, illus., table, 1967.

Four episodes of metamorphism in an area astride the Grenville Front are described and related to various orogenic events whose tentative ages are given: (1) Hudsonian (Penokean) deformation (1680–1700 m.y.), represented by non-cylindrical folds on the east-west axes, and accompanied by a regional metamorphism of green schist facies; (2) Killarnean orogeny (1170–1200 m.y.) and regional metamorphism ranging from garnet grade at the Grenville Front to higher amphibolite facies southwest of the front; (3) postkinematic contact metamorphism around Killarnean granites giving rise to crystallization of muscovite-andalusite-cordierite-oligoclase-quartz-chlorite-garnet assemblages in the inner contact aureole; and (4) nonpervasive post-Keweenawan? retrogressive metamorphism accompanied by cataclasis (950 m.y.).—AH

05900 **Brooner, Frank I., Jr.** Shale diapirs of the lower Texas Gulf Coast as typified by the north LaWard diapir: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 126–134, illus., 1967.

The North LaWard, a typical example of a shale diapir, is used as an acquaintance-maker. The possible economic significance in future exploration of buried lower Frio structures also is pointed out. This shale diapir has intruded the lower Frio to a depth of approximately 1,100 feet above its base, and appears to have taken place as late as upper Frio time. Shale diapirs that have not intruded the lower Frio are believed to have formed many of the lower Frio buried structures such as Una West, Portilla, and Copano fields. The timing and extent of the intrusions is a critical factor in the economic potential of the structures.—HRC

Broussard, W. L. *See* Shattles, D. E. 05639

Brown, Robert J. *See* Cole, Gerald A. 05743

00081 **Brune, James N.** Seismic moment, seismicity, and rate of slip along major fault zones: Jour. Geophys. Research, v. 73, no. 2, p. 777–784, illus., tables, 1968.

A straightforward method for computing rates of slip from earthquakes in major fault zones is presented. The slip rate is calculated from the sum of moment for the earthquakes. Rates obtained are in approximate agreement with rates obtained from geodetic measurements or magnetic anomalies, provided that long time samples are considered and provided that adjustments are made in the vertical extent of the zone of earthquake generation. For some fault zones, particularly deep island arc shear zones, strain is perhaps being relieved by steady creep, whereas, in other

fault zones, e.g., the San Andreas, strain is accumulating for a large earthquake. The zone of earthquake generation for oceanic transform faults may be as little as 5 km in vertical extent.—Authors' abstract

05892 **Brune, James N.; King, Chi-Yu.** Excitation of mantle Rayleigh waves of period 100 seconds as a function of magnitude: Seismol. Soc. America Bull., v. 57, no. 6, p. 1355–1365, illus., tables, 1967.

The excitation of mantle Rayleigh waves of 100 sec period as a function of magnitude is studied using data from 91 earthquakes in the magnitude range 5.0–8.9. The data were recorded on a wide variety of instruments including Milne-Shaw horizontal pendulums and modern long-period high-gain inertial seismographs. The larger earthquakes studied range in time from 1923 to 1964. Mantle Rayleigh wave amplitudes are corrected to a distance of 90° and plotted as a function of surface wave magnitude. The data are compared with theoretical curves based on a moving source model and two statistical models discussed by Aki. It is concluded that for large earthquakes the source may be approximated by a point couple which propagates a distance given approximately by the length of the aftershock zone.—Authors' abstract

Bryant, W. R. *See* Jones, B. R. 05943

Bufe, Charles G. *See* Schimke, Gerald R. 00090

05787 **Bullen, K. E.** Basic evidence for Earth divisions, Chap. 2 *in* The Earth's mantle (T. F. Gaskell, editor): London and New York, Academic Press, p. 11–39, illus., tables, 1967.

Layering of the Earth's interior is based on traveltime data of seismic body waves. Tables of traveltime data related to a spherically symmetrical model Earth were adequate for locating the layers approximately. Recent work on natural earthquakes and nuclear explosions reveals the need for both considerable amendment of the tables, and increase in resolving power of the recorded data. Mechanical properties of the layers are derived from relations between density, compressibility, rigidity, pressure and gravitational intensity. A variety of mathematical Earth models has been derived from the calculations. On the hypothesis that below the upper mantle compressibility varies smoothly with pressure, important inferences can be drawn on variations of density in the lower mantle, solidity of the inner core, and its central density.—JPF

Bullock, W. D. *See* Rana, M. H. 00034

05953 **Bunch, T. E.; Keil, Klaus; Snetsinger, K. G.** Chromite composition in relation to chemistry and texture of ordinary chondrites, *in* Meteorites and tektites: Geochim. et Cosmochim. Acta, v. 31, no. 10, p. 1569–1582, illus., tables, 1967.

Analyses of chromite from 46 ordinary chondrites were made using electron microprobe techniques. The composition of chromite in "equilibrated" ordinary chondrites changes in an orderly fashion from H to L to LL groups, in accordance with changes in olivine and orthopyroxene compositions. Within the three major ordinary chondrite groups, chromite composition is related to petrographic subgroup. The observed trends are consistent with either a metamorphic or primary igneous origin of chondrites of different petrographic subgroups. Vanadium is enriched in chromite in comparison to the bulk meteorite by a factor of 70.—*from* Authors' abstract

Burbridge, Patricia Parks. *See* Felix, Charles J. 05838

Burgess, Frederick J. *See* Olson, Theodore A. 05851

Burnett, D. S. *See* Bogard, D. D. 05814

05970 **Burns, Robert E.; Grim, Paul J.** Heat flow in the Pacific Ocean off central California: Jour. Geophys. Research, v. 72, no. 24, p. 6239–6247, illus., table, 1967.

As a part of the Upper Mantle Project, a marine geophysical survey has been conducted off central California, between 35° and 39° N., extending about 800 km offshore. Heat flow measurements were made at 31 stations including 12 along a special section between the highest and lowest values previously reported. The heat flow is relatively constant (1.7 to 1.8 μ cal cm^{-2} sec^{-1}) over the eastern part of the continental rise; farther offshore a banding of high and low heat flow on a regional scale (wavelengths of several hundred kilometers) is present. Shorter wavelength fluctuations (about 50 km) in the heat flow are detected by the closely spaced stations along the special section.—Authors' abstract

00118 **Buseck, Peter R.; Goldstein, Joseph I.** Pallasitic meteorites—Implications regarding the deep structure of asteroids: Science, v. 159, no. 3812, p. 300–302, illus., 1968.

Olivine compositions in pallasites exhibit a bimodal distribution and indicate a high degree of internal equilibrium. Cooling rates measured in the metal phases are uniform and consistently lower than those of most iron meteorites. These factors suggest that the pallasites were derived from few parent bodies, and that they crystallized in a highly insulated site—presumably the core of their parent body. Most iron meteorites were derived either from isolated areas closer to the surface or from other parent bodies.—Authors' abstract

00154 **Cain, John M.; Beatty, Marvin T.** The use of soil maps in the delineation of flood plains: Water Resources Research, v. 4, no. 1, p. 173–182, illus., tables, 1968.

Rare floods along the Mississippi River inundated over 99 percent of the soils that would be expected to flood, but in addition flooded 7 percent of the terrace soils. Flooding predicted with soils information was compared with flooding predicted with an engineering study for small streams in a mature landscape in Wisconsin. For a 100 year synthetic flood an agreement of ±4.5 percent was obtained. Comparison of flooding with soil types indicated that alluvial soils flood frequently, and also, soils with restricted drainage and of fluvial origin, although some data are inconclusive. In areas where man-made works do not appreciably alter the stream regimen, and where extensive flood plains must be delineated, accurate soil maps, properly interpreted, give a good estimate of areas subject to flooding.—*from* Authors' abstract

Call, Richard D. *See* Halstead, Perry N. 00046

Callahan, J. A. *See* Shattles, D. E. 05639

Campanella, Richard G. *See* Mitchell, James K. 00133

05646 **Campbell, Bernard G.** Human evolution—An introduction to man's adaptations: Chicago, Ill., Aldine Publishing Co., 425 p., illus., tables, 1967.

The author has tried to expand the subject of evolving man from skeleton and dental transformations to one requiring knowledge of many fields of biology. Chapter headings are: evolution and environment; progress in homeostasis; primate radiation; body structure and posture; locomotion and the hindlimb; manipulation and the forelimb; feeding, ecology, and behavior; evolution of the head; reproduction, the family, and social structure; culture and society; and the origin of man. A two-page appendix lists fossil evidence for human evolution. A list of references for further reading, and a glossary complete the book.—ESL

05672 **Campbell, L. D.** Biostratigraphy and paleoecology of Yates Cut, Williamsburg, Virginia [abs.]: Virginia Jour. Sci., v. 18, no. 4, p. 184, 1967.

05481 **Canada Geological Survey.** Aeromagnetic map, Kingfisher Lake, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3734, scale 1:63,360, 1967.

05482 **Canada Geological Survey.** Aeromagnetic map, Kaneesose Lake, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3735, scale 1:63,360, 1967.

05483 **Canada Geological Survey.** Aeromagnetic map, Nemeigusabins Lake, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3736, scale 1:63,360, 1967.

05484 **Canada Geological Survey.** Aeromagnetic map, Sandybank Lake, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3737, scale 1:63,360, 1967.

05485 **Canada Geological Survey.** Aeromagnetic map, Goose River, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3738, scale 1:63,360, 1967.

05486 **Canada Geological Survey.** Aeromagnetic map, Sheet 53 I/5, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3739, scale 1:63,360, 1967.

05487 **Canada Geological Survey.** Aeromagnetic map, Dog Lake, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3740, scale 1:63,360, 1967.

05488 **Canada Geological Survey.** Aeromagnetic map, Sheet 53 I/13, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3741, scale 1:63,360, 1967.

05489 **Canada Geological Survey.** Aeromagnetic map, Whitefish Lake, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3742, scale 1:63,360, 1967.

05490 **Canada Geological Survey.** Aeromagnetic map, Sheet 53 P/5, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3743, scale 1:63,360, 1967.

05491 **Canada Geological Survey.** Aeromagnetic map, Sheet 53 P/12, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3744, scale 1:63,360, 1967.

05492 **Canada Geological Survey.** Aeromagnetic map, Niskibi Lake, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3745, scale 1:63,360, 1967.

05493 **Canada Geological Survey.** Aeromagnetic map, Sheet 54 A/4, Kenora and Winnipeg mining districts, Ontario–Manitoba: Canada Geol. Survey Geophysics Paper 3746, scale 1:63,360, 1967.

05494 **Canada Geological Survey.** Aeromagnetic map, Commission Lake, Kenora and Winnipeg mining districts, Ontario–Manitoba: Canada Geol. Survey Geophysics Paper 3747, scale 1:63,360, 1967.

05495 **Canada Geological Survey.** Aeromagnetic map, Sheet 54 A/12, Kenora and Winnipeg mining districts, Manitoba–Ontario: Canada Geol. Survey Geophysics Paper 3748, scale 1:63,360, 1967.

05496 **Canada Geological Survey.** Aeromagnetic map, Sheet 54 A/13 and part of 54 H/4, Winnipeg mining district, Manitoba: Canada Geol. Survey Geophysics Paper 3749, scale 1:63,360, 1967.

05497 **Canada Geological Survey.** Aeromagnetic map, Ahmabel Lake, District of Cochrane, Ontario: Canada Geol. Survey Geophysics Paper 3888, scale 1:63,360, 1967.

05498 **Canada Geological Survey.** Aeromagnetic map, Pitopike River, District of Cochrane, Ontario: Canada Geol. Survey Geophysics Paper 3889, scale 1:63,360, 1967.

05499 **Canada Geological Survey.** Aeromagnetic map, Sheet 42 K/2, District of Cochrane, Ontario: Canada Geol. Survey Geophysics Paper 3890, scale 1:63,360, 1967.

05500 **Canada Geological Survey.** Aeromagnetic map, Little Ash River, District of Cochrane, Ontario: Canada Geol. Survey Geophysics Paper 3891, scale 1:63,360, 1967.

05501 **Canada Geological Survey.** Aeromagnetic map, Kingfisher River, District of Cochrane, Ontario: Canada Geol. Survey Geophysics Paper 3892, scale 1:63,360, 1967.

05502 **Canada Geological Survey.** Aeromagnetic map, Little Drowning River, District of Cochrane, Ontario: Canada Geol. Survey Geophysics Paper 3893, scale 1:63,360, 1967.

05503 **Canada Geological Survey.** Aeromagnetic map, Sheet 42 N/2, Districts of Kenora and Cochrane, Ontario: Canada Geol. Survey Geophysics Paper 3894, scale 1:63,360, 1967.

05504 **Canada Geological Survey.** Aeromagnetic map, Sheet 42 N/7, Districts of Kenora and Cochrane, Ontario: Canada Geol. Survey Geophysics Paper 3895, scale 1:63,360, 1967.

05505 **Canada Geological Survey.** Aeromagnetic map, Sheet 42 N/10, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3896, scale 1:63,360, 1967.

05506 **Canada Geological Survey.** Aeromagnetic map, Sheet 42 N/15, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3897, scale 1:63,360, 1967.

05507 **Canada Geological Survey.** Aeromagnetic map, Sheet 43 C/2, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3898, scale 1:63,360, 1967.

05508 **Canada Geological Survey.** Aeromagnetic map, Sheet 43 C/7, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3899, scale 1:63,360

05509 **Canada Geological Survey.** Aeromagnetic map, Sheet 43 C/10, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3900, scale 1:63,360, 1967.

05510 **Canada Geological Survey.** Aeromagnetic map, Smoothstone Lake, Saskatchewan: Canada Geol. Survey Geophysics Paper 4597, scale 1:63,360, 1967.

05511 **Canada Geological Survey.** Aeromagnetic map, Randall Lake, Saskatchewan: Canada Geol. Survey Geophysics Paper 4598, scale 1:63,360, 1967.

05512 **Canada Geological Survey.** Aeromagnetic map, Varey Lake, Saskatchewan: Canada Geol. Survey Geophysics Paper 4599, scale 1:63,360, 1967.

05513 **Canada Geological Survey.** Aeromagnetic map, Ennis Lake, Saskatchewan: Canada Geol. Survey Geophysics Paper 4600, scale 1:63,360, 1967.

05514 **Canada Geological Survey.** Aeromagnetic map, Dowd Lakes, Saskatchewan: Canada Geol. Survey Geophysics Paper 4601, scale 1:63,360, 1967.

05515 **Canada Geological Survey.** Aeromagnetic map, Sheet 73 I/9, Saskatchewan: Canada Geol. Survey Geophysics Paper 4602, scale 1:63,360, 1967.

05516 **Canada Geological Survey.** Aeromagnetic map, Ballantyne Bay, Saskatchewan: Canada Geol. Survey Geophysics Paper 4603, scale 1:63,360, 1967.

05517 **Canada Geological Survey.** Aeromagnetic map, Limestone Lake, Saskatchewan: Canada Geol. Survey Geophysics Paper 4604, scale 1:63,360, 1967.

05518 **Canada Geological Survey.** Aeromagnetic map, Hanson Lake, Saskatchewan: Canada Geol. Survey Geophysics Paper 4605, scale 1:63,360, 1967.

05519 **Canada Geological Survey.** Aeromagnetic map, Denare Beach, Saskatchewan: Canada Geol. Survey Geophysics Paper 4606, scale 1:63,360, 1967.

05520 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 89 B/NW, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4886, scale 1:126,720, 1967.

05521 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 99 A/NE, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4887, scale 1:126,720, 1967.

05522 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 99 A/NW, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4888, scale 1:126,720, 1967.

05523 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 89 C/SW, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4889, scale 1:126,720, 1967.

05524 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 99 D/SE, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4890, scale 1:126,720, 1967.

05525 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 99 D/SW, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4891, scale 1:126,720, 1967.

05526 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 99 C/SE, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4892, scale 1:126,720, 1967.

05527 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 99 C/SW, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4893, scale 1:126,720, 1967.

05528 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 99 D/NE, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4895, scale 1:126,720, 1967.

05529 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 99 D/NW, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4896, scale 1:126,720, 1967.

05530 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 99 C/NE, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4897, scale 1:126,720, 1967.

05531 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 99 C/NW, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4898, scale 1:126,720, 1967.

05532 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 109 D/NE, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4899, scale 1:126,720, 1967.

05533 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 109 D/NW, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4900, scale 1:126,720, 1967.

05534 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 99 E/SW, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4904, scale 1:126,720, 1967.

05535 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 99 F/SE, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4905, scale 1:126,720, 1967.

05536 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 99 F/SW, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4906, scale 1:126,720, 1967.

05537 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 109 E/SW, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4908, scale 1:126,720, 1967.

05538 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 109 F/SE, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4909, scale 1:126,720, 1967.

05539 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 109 F/SW, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4910, scale 1:126,720, 1967.

05540 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 99 E/NE, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4911, scale 1:126,720, 1967.

05541 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 99 E/NW, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4912, scale 1:126,720, 1967.

05542 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 99 F/NE, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4913, scale 1:126,720, 1967.

05543 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 99 F/NW, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4914, scale 1:126,720, 1967.

05544 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 109 E/NW, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4916, scale 1:126,720, 1967.

05545 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 109 F/NW, Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4918, scale 1:126,720, 1967.

05546 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 99 G/SW, Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4920, scale 1:126,720, 1967.

05547 **Canada Geological Survey.** Aeromagnetic map, Polar Continental Shelf, Sheet 109 H/SW, District of Franklin, Northwest Territories: Canada Geol. Survey Geophysics Paper 4922, scale 1:126,720, 1967.

05950 **Caner, B.; Cannon, W. H.; Livingstone, C. E.** Geomagnetic depth sounding and upper mantle structure in the Cordillera region of western North America: Jour. Geophys. Research, v. 72, no. 24, p. 6335–6351, illus., 1967.

This report describes recent geomagnetic depth-sounding investigations on the inland (Cordillera) anomaly first reported by Schmucker at lat 32°N; it includes Hyndman's profile at lat 49.5°N. and two subsequent profiles at lat 35°N. and 51°N. All three profiles crossed the transition between the 'high-I' and 'low-I' zones. Characteristic parameters have been derived from power spectral analysis of data. Attenuation in the normalized vertical component at the western stations increases with frequency, from 0.97±0.65 db at 0.025 c/ks to 8.10±1.25 db at 0.35 c/ks. Attenuation is uniform along all three profiles, confirming that the same conductivity structure exists in southwest United States and southern British Columbia. Quantitative analysis indicates a rise of highly conducting material (10^{-11} emu±20 percent) to within 25–35 km of surface under the western region.—*from* Authors' abstract

Cannon, W. H. *See* Caner, B. 05950

05615 **Carlisle, Norman.** Riches of the sea—The new science of oceanology: New York, Sterling Publishing Co., 128 p., illus., 1967.

In this book the science of oceanology, which includes oceanography, is completely explained, including present-day experiments, descriptions of submersible craft, their capabilities for deep-sea dives, and use as ocean-bottom laboratories. Considerable data is made available in the exploration for mineral resources on and beneath the sea bottom, in the drilling for petroleum, and in the Mohole experiments; also in study of the riches of the sea water, and its desalination. Challenges include harnessing power from the sea, predicting and taming of hurricanes and tsunamis, locating icebergs, and underwater archaeology. Photographs and drawings help to explain the text and point out features.—GDC

Carswell, Louis D. *See* McKelvey, Vincent E. 05618

05840 **Carter, G. S.** Structure and habit in vertebrate evolution: Seattle, Wash., Univ. Washington Press, 520 p., illus., table, 1967.

The book deals primarily with the major changes that took place at the origin of each class, and enabled the vertebrates to become dominant almost everywhere. An introductory chapter summarizes interpretation of the evolutionary process on the basis of results from recent work. The following 18 chapters are devoted to: pre-vertebrates; Agnatha; the ammocoete as a primitive vertebrate organization; Acanthodii and Placodermi; Chondrichthyes; Osteichtyes; life in fresh waters; fish; Amphibia, evolution and reorganization; Reptilia; fully terrestrial life; birds, origin and skeleton, and biology; reptilian ancestry of mammals; monotremes; and mammalian reorganization, structure and biology. In the concluding chapter some problems in the theory of evolution raised by these facts are discussed. Appendixes give the geologic time table, and an outline classification of chordates.—ESL

Casaday, K. B. *See* McEvilly, T. V. 05908

05600 **Cebull, Stanley Edward.** Bedrock geology of the southern Grant Range, Nye County, Nevada [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1986B-1987B, 1967.

00150 **Champlin, J. B. F.; Eichholz, G. G.** The movement of radioactive sodium and ruthenium through a simulated aquifer: Water Resources Research, v. 4, no. 1, p. 147-158, illus., 1968.

The contribution made by water in transporting ionic materials through soils was studied by injecting radioactive solutions into a model aquifer containing sand. The progress of the solutions was monitored by a collimated Geiger-Müller tube. The appearance of the radioactivity in the effluent, which marked the arrival of the Na front, was correlated with an increase in suspended particulate matter, K and Ca concentrations, and over-all conductivity. Of particular significance was that part of the radioactivity related directly to the filterable mass of particles in the effluent, despite the high solubility of the ion used. Both the Na and Ru studies showed that a significant amount of radioactivity was transported through the test bed on particulate matter large enough to be trapped on 0.45 micron membrane filters.—*from* Authors' abstract

Chapman, Rodger H. *See* Bishop, Charles C. 05767

Chapman, T. G. *See* McGilchrist, C. A. 00138

05443 **Chave, Keith E.** Recent carbonate sediments—An unconventional view: Jour. Geol. Education, v. 15, no. 5, p. 200-204, illus., tables, 1967.

Data presented indicate that carbonate sediments are forming today in many areas of high latitude and cold water, surface waters in high latitudes are supersaturated with $CaCO_3$, and calcareous organisms in nontropical areas calcify rapidly. Paleoenvironmental interpretations of carbonate rocks should consider these three

observations, and the suggestion that river-derived sediments control the distribution of carbonate sediments by diluting skeletal carbonates with clastics. Bryozoans, abundant in nontropical sediments, are never common in tropical sediments, although common in many carbonate rocks as far back as the Ordovician.—GDC

05912 **Cheetham, Alan H.** Paleoclimatic significance of the bryozoan *Metrarabdotos*, *in* Symposium on the geological history of the Gulf of Mexico, Antillean-Caribbean region: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 400–407, illus., tables, 1967.

The tropical distribution of recent populations of *Metrarabdotos* is a consequence of a temperature tolerance of 61° to 82°F. This stenothermy and generic distinctiveness make it a useful fossil for identifying tropical faunal provinces during the Cenozoic. The northern limit has fluctuated during late Paleogene and Neogene time; the amplitude of fluctuation has been 8° in the New World and 34° in Eurafrica. The synchronous latitudinal shifts on both sides of the Atlantic reflect variations in Atlantic marine climate. The greater amplitude of variations in Eurafrica is probably the result of a surface current gyre similar to the modern one. The pattern of increasing amplitude fluctuations does not agree with a paleoclimatic model of cooling from early to late Tertiary time.—*from* Author's abstract

05601 **Chen, Ju-chin.** Petrological and chemical studies of Utuado pluton, Puerto Rico [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1987B, 1967.

Cheney, T. M. *See* McKelvey, V. E. 05473

05674 **Christensen, John T.; Felder, Wilson N.; Ellison, Robert L.** Recent benthonic foraminiferida in the upper Patuxent River estuary, Maryland, and the effect of temperature change on their distribution [abs.]: Virginia Jour. Sci., v. 18, no. 4, p. 184–185, 1967.

00057 **Chuber, Stewart; Rodgers, Elton E.** Pennsylvanian-Wolfcamp study [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 52, no. 1, p. 194, 1968; Shale Shaker, v. 18, no. 5, p. 101, 1968.

05772 **Clark, Sydney P., Jr.; Ringwood, A. E.** Density, strength and constitution of the mantle, Chap. 6 *in* The Earth's mantle (T. F. Gaskell, editor): London and New York, Academic Press, p. 111–124, illus., tables, 1967.

Seismic velocity-depth curves are critical to interpretation of mantle constitution. Recognition of a widespread low velocity zone in the upper mantle also assumes a region of relatively high velocity overlying it. Models of Earth density changes due to self-compression in homogeneous layers are inconsistent with existence of low velocity layers. Petrographic models of the upper mantle reveal that density decreases with depth at first. Rheological properties of the mantle probably lie between limiting extremes set by Newtonian viscosity or by perfect plasticity. Distribution of strength or viscosity with depth is subject to requirements of isostasy. The name pyrolite has been proposed for mantle peridotite; the pyrolite model gives results broadly consistent with seismic data. Major phase transformations involving change in silica coordination occur in the transition zone, beyond which material remains homogeneous over a wide pressure range.—JPF

05761 **Clary, Michael R.** Geologic map and sections of the eastern part of the Clark Mountain Range, San Bernardino County, California: California Div. Mines and Geology Map Sheet 6, scale 1:24,000, sections, text, 1967.

Exposed formations in the map area range in age from Precambrian to Recent, although no units between the Lower Triassic to Pleistocene interval were noted. Principal structural features are a thrust fault and four northwest-trending normal faults which divide the bedrock into six northwest-trending fault blocks. The only significant fold is a shallow northwestward plunging syncline, the axis of which almost bisects the Mesquite thrust. There is no conclusive evidence of the time when deformation began or ended, but major faulting is younger than the early Triassic Moenkopi Formation; deformation is considered to have occurred during the late Cretaceous-early Tertiary Laramide orogeny.—MCM

05740 **Cleary, John.** Azimuthal variation of the Longshot source term: Earth and Planetary Sci. Letters, v. 3, no. 1, p. 29–37, illus., table, 1967.

The P-times from Longshot [nuclear explosion in the Aleutian Islands] are strongly biased by the presence of azimuthal variation in the source term, which has produced error in the traveltime curves of Chinnery and Toksöz. When corrections are made, the curves agree with those of Cleary and Hales. The azimuthal variation is caused by a slab of high-velocity material dipping steeply beneath the Aleutian arc. The material could be olivine showing strong anisotropy. If this is common in arc regions, it represents a point source for error in the detection of earthquake locations.—*from* Author's abstract

05673 **Clement, Stephen C.** Concentration of supergene copper mineralization by altered plagioclase feldspar, Battle Mountain, Nevada [abs.]: Virginia Jour. Sci., v. 18, no. 4, p. 184, 1967.

Cline, L. M. *See* Briggs, Garrett. 05750

00157 **Cloud, Preston E., Jr.** Realities of mineral distribution [summ.]: Oklahoma Geology Notes, v. 28, no. 1, p. 21–24, 1968.

The concept of unlimited resources, which denies the restraints and belittles the difficulties, is based on five premises: the promise of essentially inexhaustible cheap useful energy, the thesis that economics is the sole factor governing availability of minerals, the fallacy of uninterrupted variation from ore to average crustal abundance, the crucial assumption of population control, and the notion of the technological fix. The realities are that mineral distribution is neither inconsiderable nor limitless, and we do not know yet the detail necessary for weighing long-range alternatives. Geologists face a growing challenge to intensify research, formulate better predictive models, and inform the public.—ESL

Cloud, William K. *See* Hudson, D. E. 05904

05905 **Cloud, William K.** Intensity map and structural damage, Parkfield, California earthquake of June 27, 1966: Seismol. Soc. America Bull., v. 57, no. 6, p. 1161–1178, illus., 1967.

The isoseismal map indicates that the main shock of the Parkfield, California, earthquake series on June 27, 1966 was felt over an area of approximately 20,000 square miles, and that the maximum Modified Mercalli scale intensity of VII was limited to a small area near the San Andreas fault zone in the vicinity of the Parkfield and Cholame. In this area an acceleration pulse of 0.5g was recorded. However, damage to homes, pipe lines, bridges and other structures was not severe.—Author's abstract

05906 **Cloud, William K.; Perez, Virgilio.** Accelerograms—Parkfield earthquake: Seismol. Soc. America Bull., v. 57, no. 6, p. 1179–1192, illus., tables, 1967.

Five accelerograms obtained during the main shock of the Parkfield earthquake series at locations adjacent to and within 10 miles of the trace of the San Andreas fault are presented together with limited analysis by electric analog methods. With one exception records from horizontal accelerometers are characterized by a short duration section of high acceleration. Adjacent to faulting an acceleration pulse of 0.5 gravity was recorded. Judged by a record from a station east of the fault on rock and a record from a station approximately the same distance west of the fault on alluvium, magnification of response spectra by alluvium was less than a factor of 3.—Authors' abstract

05872 **Coates, D. F.** Rock mechanics principles: Canada Dept. Energy, Mines and Resources Mines Br. Mon. 874, [363] p., illus., tables, revised 1967; originally published 1965.

Eight chapters cover: the mechanical nature of rocks; elastic prototypes; shafts, drifts, and tunnels; pillars, stopes, caving, and subsidence; rock slopes; foundations; and rock dynamics. Appendixes include: symbols and abbreviations, a glossary;

flow nets; stress concentration factors; beam formulae; and dimensional analysis and similitude. A subject index has been added in the revision, and a section on fill is added to Chapter 5. The monograph was also revised to make it more suitable as a beginning text.—ESL

Cobb, Edward H. *See* Berg, Henry C. 05852

00100 **Coester, B. B.; Williams, Jacob L.** Relationships of oil composition and stratigraphy in multipay fields [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 52, no. 1, p. 195, 1968; Shale Shaker, v. 18, no. 5, p. 100, 1968.

05743 **Cole, Gerald A.; Whiteside, Melbourne C.; Brown, Robert J.** Unusual monomixis in two saline Arizona ponds: Limnology and Oceanography, v. 12, no. 4, p. 584–591, illus., tables, 1967.

Red Pond and Green Pond, shallow, saline pools in Apache County, stratify chemically in winter and circulate in midsummer; they occupy depressions in Tertiary sands intercepting the water table of the weakly cemented Bidahochi formation. Stability is brought about by addition of dilute runoff and seep water; circulation occurs because evaporation increases salinity of upper waters and lowers pond surfaces. Winter stabilities are in excess of 200 g-cm/cm^2 in spite of anomalous temperature profiles and shallow nature of ponds. Waters are chloro-carbonates derived by concentration from dilute waters relatively high in sulfate and carbonate; at the overturn, ponds have salinities of 22 and 11 percent. Phosphate concentrations are high—up to 500 mg/liter in Red Pond. *Ctenocladus circinnatus* in both ponds may be the fourth North American record for this green algae.—*from* Authors' abstract

Collier, Albert. *See* Puri, H. S. 05927

00148 **Collins, Jim.** Pharr McAllen Field, Hidalgo County, Texas [abs.]: South Texas Geol. Soc. Bull., v. 8, no. 2, p. 1–2, 1968.

05602 **Colwell, John Allison.** Geochemistry and petrology of the Nipissing diabase in Ontario [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1987B, 1967.

Compston, W. *See* Bofinger, V. M. 05917

05896 **Condie, Kent C.** Geochemistry of early Precambrian graywackes from Wyoming: Geochim. et Cosmochim. Acta, v. 31, no. 11, p. 2135–2149, illus., tables, 1967.

Twenty-three samples of slightly metamorphosed early Precambrian graywackes from the southern Wind River Mountains in Wyoming have been analyzed for Si, Al, Ti, Fe, Mg, K, Ca, Rb, Sr, Zr and Ni by X-ray fluorescence and for Na and Mn by neutron activation; modal analyses have also been made. The original chemical composition of the graywackes appears not to have been greatly affected by diagenesis and metamorphism. The chemical composition indicates that the source area was predominantly quartz diorite to granodiorite in composition. Relatively large amounts of Fe, Mg, and Ni and a high Mg/Fe ratio in some graywackes suggest a minor mafic component in the source area. Rock and mineral fragments in the graywacke indicate a source area composed chiefly of quartz-rich metasedimentary rocks with lesser amounts of granitic rock.—*from* Author's abstract

05882 **Conybeare, C. E. B.** Influence of compaction on stratigraphic analyses: Bull. Canadian Petroleum Geology, v. 15, no. 3, p. 331–345, illus., tables, 1967.

This paper concerns stratigraphic problems involving correlation of sections formed under conditions of variable rates of sedimentation and subjected to differential compaction. Based on empirical data, tables and graphs can be constructed for determining equivalent rock-time units in two or more sections. Examples are given to illustrate application of this method to stratigraphic problems involving reconstruction of sedimentological and paleogeographical environments.—Author's abstract

05789 **Cook, A. H.** Gravitational considerations, Chap. 4 *in* The Earth's mantle (T. F. Gaskell, editor): London and New York, Academic Press, p. 63–87, illus., tables, 1967.

The Earth's external gravity field arises from the internal distribution of mass. Observations of gravitational potential and luni-solar precession show that the Earth is strongly condensed toward the center. Behavior of the Earth as a whole, as shown in the Chandler free motion of the axis of rotation, demonstrates that it has a fluid core and that the elastic properties of the mantle are consistent with those derived from seismological data. There are components of the external potential which do not arise from crustal structure. Scales of variation of potential and heat flow indicate that the factors which influence both lie probably in the upper mantle. Earth tide observations are too scattered and subject to extraneous effects to show variations of elastic properties from place to place in the upper mantle.—JPF

05724 **Cook, Douglas R.** Suggestions for increasing metalliferous ore discoveries by more effective use of exploration techniques [abs.]: Mining Eng., v. 19, no. 12, p. 32, 1967.

05471 **Cooksley, James W., Jr.** Application of geophysical methods in phosphate exploration, southeastern Idaho, *in* Anatomy of the western phosphate field—Intermountain Assoc. Geologists, 15th Ann. Field Conf. 1967: Salt Lake City, Utah, Intermountain Assoc. Geologists, p. 161–166, illus., 1967.

Geophysical exploration appears to have important applications to exploration for phosphate in southeastern Idaho. The refraction seismic survey has been used to identify geologic units, locate weathered phosphate beds and determine extent and depths of weathering, define geologic structure, study slope stability, and determine rippability and compute mining costs. Well logging has been used to identify geologic units and determine vertical extent and degree of weathering. Electrical resistivity is undergoing feasibility tests to identify geologic units and study weathering characteristics. The gravimetric method has been used once this year in Utah to determine thickness of overburden.—KAS

05704 **Coolbaugh, M. J.** Special problems of mining in deep potash: Mining Eng., v. 19, no. 5, p. 68–73, illus., 1967.

As part of a program to design safe, stable mine workings for a deep potash operation in Saskatchewan, the structural properties of potash and salt under high stress conditions were studied. Laboratory experiments included transition, photoelastic, and creep-rate testing. Actual creep rates measured agreed well with the forecasts. Under the stress conditions ordinarily encountered in mining, most rocks behave as elastic materials. Potash and salt, however, become slightly plastic at relatively low pressures and yield to stress by flowing. In mine openings the amount of horizontal closure of the walls is almost twice that of the vertical closure of the roof and floor. Horizontal strain is the greatest at the surface of an opening; however, vertical strain is greatest several feet above the surface.—MAC

05878 **Cooley, M. E.** (compiler). Arizona highway geologic map: [Tucson, Ariz.] Arizona Geol. Soc., scale 1:1,000,000, text, 1967.

The text includes an inset physiographic map with accompanying illustrations of features, and maps showing stages of the geological evolution in Arizona. Although exposed rocks record only about half of geological time, collectively they comprise one of the most complete sections in the North American continent. The text presents the geologic history from Precambrian through Quaternary time.—MCM

05868 **Cordey, W. G.** The development of *Globigerinoides ruber* (D'Orbigny, 1839) from the Miocene to the Recent: Palaeontology, v. 10, no. 4, p. 647–659, illus., 1967.

Specimens from the Miocene Cipero Formation of Trinidad, the Miocene and Pleistocene of Jamaica, a Tertiary-Quaternary core from the mid-Pacific, and elsewhere are studied. Early to middle Miocene forms can be distinguished from upper Miocene to Recent forms on the basis of ontogeny and phylogeny. The early

to middle Miocene forms are put in *G. subquadratus*, the younger forms in *G. ruber*. Possible ancestral forms are described and discussed. There is much variation in the wall structure, but no fundamental differences.—*from* Author's abstract

05603 **Corgan, James Xavier.** Quaternary micromolluscan fauna of the Mudlump Province, Mississippi River Delta [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1988B, 1967.

00116 **Cowan, J. C.** Geology of the Strathcona ore deposit: Canadian Mining and Metall. Bull., v. 61, no. 669, p. 38–54, illus., tables, 1968.

Strathcona nickel–copper mine is on the north edge of the Sudbury Basin on an embayment of the footwall contact of the Sudbury nickel irruptive. Most of the ore is in a zone of late granite breccia between norite and gneiss. Sulfide minerals are pyrrhotite, pentlandite, and chalcopyrite with accessory magnetite–ilmenite and pyrite. Orebodies were emplaced by a combination of gravitative differentiation of sulfides and injection of sulfide magma.—ARK

Cox, Allan. *See* Dalrymple, G. Brent. 00142

05827 **Cox, Allan; Dalrymple, G. Brent.** Geomagnetic polarity epochs—Nunivak Island, Alaska: Earth and Planetary Sci. Letters, v. 3, no. 2, p. 173–177, illus., table, 1967.

New paleomagnetic and potassium–argon dating measurements have been made on basalt flows from Nunivak Island, Alaska, with the following results: (1) The best estimate of the age of the Brunhes/Matuyama polarity epoch boundary is found to be 0.694 m.y. (2) The best estimate of the age of the Gauss/Gilbert boundary is 3.32 m.y. (3) Three normally magnetized flows with ages from 0.93 to 0.88 m.y. are in accord with previous estimates of the age and duration of the Jaramillo normal event. (4) One normally magnetized flow with an age of 1.65 ± 0.09 m.y. supplies additional evidence for the Gilsá normal event. (5) Two new normal events are identified within the Gilbert reversed epoch, the "Cochitit normal event" with an age of 3.7 m.y. and the "Nunivak normal event" with an age of 4.1 m.y.—Authors' abstract

00121 **Craig, Harmon.** Zircon lead loss—A kinetic model: Science, v. 159, no. 3813, p. 447, illus., 1968.

A model consistent with the results reported by Pidgeon, O'Neil, and Silver (1966) on lead loss from a metamict Ceylon zircon at fluid pressure of 1,000 bars at 500°C is found. The simplest model is one in which the lead–loss process is instantaneously first–order with a variable rate constant reflecting in turn a first–order "annealing" process. The overall loss process is then described by the two equations $d \ln f/dt = -k$ and $d \ln (k-k^*)/dt = -a$, where f is the fraction of the original lead still present in the crystal, k is the variable rate constant for the leaching process, k^* is the "fully annealed" limiting value of k, and a is the annealing–time constant.—DBV

Craighead, Frank C. *See* Scholl, David W. 05925

Cressman, E. R. *See* Sheldon, R. P. 05456

Cressman, E. R. *See* McKelvey, V. E. 05473

05835 **Crosby, Gary W.** High–angle dips at erosional edge of overthrust faults: Bull. Canadian Petroleum Geology, v. 15, no. 3, p. 219–229, illus., 1967.

Geologic data indicate that overthrust fault surfaces commonly dip less than 15° over broad areas. High dips of 30° to 80° observed at the fault trace is attributed to toreva block faulting at the erosional edges of thrust plates. Examples of toreva block faulting along the Absaroka overthrust can be seen near Kemmerer, Wyo.—JRG

05821 **Cross, A. T.; Thompson, G. G.; Zaitseff, J. B.** Source and distribution of palynomorphs in bottom sediments, southern part of the Gulf of California [abs.]: Rev. Palaeobotany and Palynology, v. 3, nos. 1–4, p. 11–12, 1967.

Cuttitta, Frank. *See* Altschuler, Z. S. 05620

00139 **Dacey, Michael F.** Stream length and elevation for the model of Leopold and Langbein: Water Resources Research, v. 4, no. 1, p. 163–166, 1968.

A random walk formulation is given for a simple model of stream profile. The basic assumptions of the model are that in a unit of distance the elevation of the stream remains constant or drops by a unit of elevation and that the probability of each event depends upon elevation. This model is analyzed to obtain the frequency functions, means, and variances for length of stream from its origin to 'sea-level' and for elevation of the stream at each unit distance from its origin.—Author's abstract

05444 **Dahlberg, E. C.; Griffiths, J. C.** Multivariate analysis of a sedimentary rock for evaluating effects of sedimentation processes: Am. Jour. Sci., v. 265, no. 10, p. 833–842, illus., tables, 1967.

A model containing four independent processes—provenance, erosion–transportation, deposition, and diagenesis—does not fit a factor matrix of seven independent factors accounting for 85 percent of the variation and derived from 240 quantitative parameters in a core sample of low rank graywacke. The first factor appears to represent the "competence of the transporting medium" due to a high correlation of grain size variation. The second factor may represent "variation in the energy of the depositional environment", having a high dependence on sorting and to a lesser degree size. The third, fourth, and fifth appear to represent components related to source area; the fourth and fifth are dominated by types of mineral grains, the fifth by proportions of matrix and rock fragments. The sixth factor, dominated by grain shape, and the seventh, by perfection of orientation may reflect some "aspect of current direction."—RWT

Dale, Barrie. *See* Wall, David. 05564

00142 **Dalrymple, G. Brent; Cox, Allan.** Paleomagnetism, potassium–argon ages and petrology of some volcanic rocks: Nature, v. 217, no 5126, p. 323–326, illus., tables, 1968.

The results of K–Ar age determinations, paleomagnetic measurements and chemical analyses obtained from three alkali olivine basalt flows and one trachyte on Cocos Island, Costa Rica are reported. The reversed remanent magnetism of the three alkali olivine basalts is the result of reversals of the Earth's field and not mineralogically controlled self reversal. The trachyte is normally magnetized. The K–Ar age determination is about 2 m.y. A similar study on the Galapagos Islands indicated that volcanism began at least 2.4 m.y. ago. Thus, there is some overlap between the volcanic activity on the Galapagos Fracture Zone and that on Cocos Ridge. Geological evidence does not contradict the idea that Cocos Island may have been a stepping stone for organisms migrating to the Galapagos Islands.—KAS

Dalrymple, G. Brent. *See* Cox, Allan. 05827

05659 **Davis, John.** In memoriam—Alden Holmes Miller [1906–1965]: Auk, v. 84, no. 2, p. 192–202, portrait, 1967.

05568 **Davis, Margaret B.** Pollen accumulation rates at Rogers Lake, Connecticut, during late- and post-glacial time: Rev. Palaeobotany and Palynology, v. 2, nos. 1–4, p. 219–230, illus., 1967.

Pollen accumulation rates are estimated by dividing pollen per unit volume in 1 ml samples from a core in the lake, by the number of years represented by each sample, determined by C-14. The rate rose from 1000/cm^2/yr 14,000 years ago to 10,000/cm^2/yr in late glacial time, reaching a maximum of 40,000/cm^2/yr 9000 years ago during Pine Pollen Zone (B). Then the rate fell to 20–25,000/cm^2/yr, remaining stable for 8000 years.—*from* Author's summary

05604 **Dean, Stuart Linden.** Geology of the Great Valley of West Virginia [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1988B, 1967.

05957 **Denny, Charles S.** Fans and pediments: Am. Jour. Sci., v. 265, no. 2, p. 81–105, illus., 1967.

Washes in desert areas probably increase in discharge downstream only in mountains; on piedmonts, discharge may decrease rapidly downfan. Using the open-system concept, a piedmont may be considered as approaching a steady state when the rate of movement of detritus from mountain to piedmont is nearly the same as the rate at which material moves from piedmont to playa or flood plain. To maintain such a steady state requires broad areas of piedmont where erosion is the dominant process. Whether these areas of erosion are areas of more or less bare rock-pediments or whether they are abandoned segments of fans depends upon the geometry of highland and lowland. Large highlands and small lowlands favor complex fans where half the surface area may no longer receive sediment but be subject to erosion, whereas broad lowlands and small highlands favor extensive pediments.—*from* Author's abstract

deRosset, W. H. *See* Elvers, D. H. 05675

deVilliers, J. M. *See* Roth, C. B. 05842

05605 **Diery, Hassan Deeb.** Stratigraphy and structure of Yakima Canyon between Roza Gap and Kittitas Valley, central Washington [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1988B–1989B, 1967.

05452 **Dinkins, Theo H., Jr.** Subsurface stratigraphy of George County, *in* George County geology and mineral resources: Mississippi Geol. Econ. and Topog. Survey Bull. 108, p. 191–227, table, 1967.

The subsurface stratigraphic column of George County includes strata from the Lower Cretaceous Sligo formation to the Miocene Hattiesburg formation. The formations, their lithic and faunal content and their contacts are discussed. The diversity of sedimentary sequences in George County necessitates subsurface correlations based on both key or index fossils and lithostratigraphic data. When feasible, correlations in this report are based on lithology. Although potential oil and gas reservoirs, ranging in age from Lower Glen Rose to lower Miocene have been tested, the search for hydrocarbons has been unproductive. The Smackover formation, although untested in George County, is regarded as a favorable objective for future drilling.—*from* Author's abstract

00122 **Dolan, Robert; Ferm, John C.** Crescentic landforms along the Atlantic coast of the United States: Science, v. 159, no. 3815, p. 627–629, illus., 1968.

An uninterrupted series of hierarchically arranged crescentic coastal landforms occurs along the Atlantic coast. Dimensional analysis suggests a geometric relation between order, amplitude, and number. The processes responsible for these features also may be continuous in nature.—Authors' abstract

05899 **Dolloff, J. H.; Rozendal, R. A.; Siratovich, E. N.; Swain, F. M.; Woncik, John.** Subsurface Upper Cretaceous stratigraphy of southwestern Arkansas: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 76–104, illus., 1967.

The entire unit is characterized by uniformity in lithologic features, a minimum of facies variations, general eastward thinning of units toward a shoreline, and features typical of neritic, eulittoral and alluvial to prodeltaic environments. The lower Woodbine Group overlies unconformably Comanchean rocks; it consists of the lower Lewis Formation and the overlying Eagle Ford Formation. The next overlying Austin Group is composed of the Tokio Formation below and the Brownstown Formation above. The Taylor Group overlies the Austin here, and is composed of four formations; these are overlain by the Navarro Group, the Nacatoch at the base and the Arkadelphia above. Each of the formations is described and its environment of deposition evaluated.—HRC

00070 **Doss, A. K., Jr.; Spiva, Frank T., Jr.** Palo Pinto Limestone production, western Runnels County, Texas: Am. Assoc. Petroleum Geologists Bull., v. 52, no. 1, p. 82–91, illus., 1968.

In 1965, 28 fields in western Runnels County produced 750,000 bbl oil from two porosity zones in the uppermost 50 feet of the Late Pennsylvanian Palo Pinto Limestone. The Palo Pinto produces only on structure, but the best fields are on low-relief structures with up-dip pinchouts of porosity. The fields produce 30–60 percent water and water drive is the key feature of the reservoirs. Up until some 10 years ago the Palo Pinto had a "hands off" reputation as an oil producer; wells produced over 75 percent water and attempts to shut it off generally resulted in shutting off all fluid. Several years ago the writers rediscovered the Palo Pinto Limestone. Wells abandoned as dry holes became commercial after the writers installed sufficiently large pumps to produce all the fluid the wells were capable of producing.—BHK

Dreeszen, V. H. *See* Keech, C. F. 05864

00151 **Drost, Walter.** (and others). Point dilution methods of investigating ground water flow by means of radioisotopes: Water Resources Research, v. 4, no. 1, p. 125–146, illus., tables, 1968.

To apply the point-dilution method of measuring rate of ground water flow by tracers, distortion of the flow field by the well must be known. The distortion can be calculated with accuracy if permeabilities of the aquifer, k_3, of the gravel pack, k_2, and the well screen, k_1, fulfill the condition $k_3 \leq k_2 \leq k_1$. By using peak-to-peak and total count methods in wells where vertical flow occurred, the depths and rates of inflow and outflow, which relate to seepage under dams, and water exploration were determined. To determine the direction of ground-water flow, a radio tracer was injected into a well-screen section and, after having left the well-screen, was detected by a collimated detector. Au-198 proved most suitable as a tracer.—*from* Authors' abstract

05778 **Drost-Hansen, W.** The structure of water and water-solute interactions, [Chap.] 5 *in* Equilibrium concepts in natural water systems—Am. Chem. Soc., 151st Ann. Mtg., Pittsburgh, 1966, Div. Water, Air and Waste Chemistry Symposium: Washington, D.C., Am. Chem. Soc. (Adv. Chemistry Ser. 67), p. 70–120, illus., 1967.

Thermal anomalies ("kinks") in the properties of water and aqueous solutions appear to be manifestations of higher-order phase transitions in structured elements of water. Some concentration-dependent anomalies are also described and discussed in terms of: (a) the occurrence of discrete structural units of water in the unaffected solvent, (b) the possible separate existence of somewhat similarly structured units in the ionic hydration atmospheres, and (c) overlapping of large (but not necessarily structured) hydration atmospheres.—Author's abstract

05956 **Drugg, Warren S.; Loeblich, Alfred R., Jr.** Some Eocene and Oligocene phytoplankton from the Gulf Coast, U.S.A.: Tulane Studies Geology, v. 5, no. 4, p. 181–194, illus., 1967.

Four distinctive new dinoflagellate species are described from the Gulf Coast Tertiary. Two of these, *Phthanoperidinium amoenum*, Oligocene, Mississippi, and *Heteraulacacysta campanula*, Eocene, Alabama, are made the bases for new genera and the new families Phthanoperidiniaceae and Heteraulacacystaceae. A new species of *Homotryblium* is described from the Oligocene of Mississippi and one of *Operculodinium* from the Eocene and Oligocene. *Heteraulacus polyedricus* (Pouchet), n. comb., is made for former *Peridinium*. Two new acritarch genera, *Ascostomocystis* and *Cyclopsiella*, each have two new species; *Ascostomocystis hydria* occurs in the Alabama Eocene and *A. potane* in the Mississippi Oligocene, both *Cyclopsiella elliptica* and *C. vieta* occur in the Oligocene of Mississippi.—*from* Authors' abstract

Duane, D. B. *See* Bajorunas, L. 05949

05954 **Durham, C. O., Jr.; Murray, Grover E.** Tectonism of Atlantic and Gulf Coastal Province, *in* Symposium on the chronology of tectonic movements in the United States: Am. Jour. Sci., v. 265, no. 5, p. 428–441, illus., 1967.

Deposition of a volume of sediments of the order of 10 million cubic kilometers in the Atlantic and Gulf Coastal Province began in Late Jurassic to Late Cretaceous

but was interrupted in large parts of the province in Middle Cretaceous, at the ends of the Cretaceous, Paleocene, and early Eocene, after the late Miocene, and into the Quaternary. The province is bounded on the landward side by Appalachian, Ouachita, and Laramide tectonic trends. The inner part rests on sialic crust, but relations on the oceanward side are uncertain.—*from* Authors' abstract

05474 **Eardley, A. J.** Idaho–Wyoming fold and thrust belt—Its divisions and an analysis of its origin, *in* Anatomy of the western phosphate field—Intermountain Assoc. Geologists, 15th Ann. Field Conf. 1967: Salt Lake City, Utah, Intermountain Assoc. Geologists, p. 35–44, illus., 1967.

The thrust faults of the Idaho–Wyoming fold and thrust belt cluster together in four areas called "thrust complexes". These are the Meade, St. Johns, Hoback, and La Barge complexes. A model, presented to illustrate the proposed concept of gravitational gliding and development of the fold and thrust belt, shows a succession of two thrust slices as the uplift and foredeep migrated eastward. There were three or four successive slides in the belt: the Paris thrust, Meade complex, St. Johns complex, and Hoback complex. The model infers that the glide masses are shallow and may be 30 miles wide and 75 miles long. The thrusting is dependent on primary uplift and basin subsidence.—KAS

05606 **Ebanks, William James, Jr.** Recent carbonate sedimentation and diagenesis, Ambergris Cay, British Honduras [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1989B, 1967.

Eberhardt, P. *See* Bogard, D. D. 05814

Eberhardt, P. *See* Eugster, O. 05823

00127 **Edwards, Donald M.; Lewis, Roland W.** Electrokinetic stabilization of an illitic clay—Discussion [of paper 5235 by M. I. Esrig and J. P. Gemeinhardt, Jr., 1967]: Am. Soc. Civil Engineers Proc., v. 94, paper 5704, Jour. Soil Mechanics and Found. Div., no. SM 1, p. 332–334, illus., 1968.

Esrig and Gemeinhardt (ibid., v. 93, no. SM 3, p. 109–128, 1967) have shown that the rate of illitic clay soil hardening by electrokinetic treatment with calcium ions is directly related to changes in pH and Atterberg limits. Results of Edwards' experiments support these findings, especially on the pH effects, and show that ions such as Mg and Al do not directly create soil hardening, but that the ion exchange alters the charge distribution on the clay particles, which then orient themselves into structures, the strongest at pH = 7.0, creating a clogging effect. Lewis obtained results agreeing essentially with those of Esrig and Gemeinhardt, but his experiments were for shorter durations—after 24 hours or less no further consolidation was noticeable; this difference may be due to the static system used by Lewis, whereas dynamic conditions prevailed in Esrig and Gemeinhardt's system.—VMJ

Ehmann, W. D. *See* Lieberman, K. W. 05973

Eichholz, G. G. *See* Champlin, J. B. F. 00150

05607 **Eisbacher, Gerhard Heinz.** Tectonic analysis in the Cobequid Mountains, Nova Scotia, Canada [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1989B–1990B, 1967.

05464 **Elders, Wilfred A.** Phase change experiments for introductory courses: Jour. Geol. Education, v. 15, no. 5, p. 185–187, illus., 1967.

High temperature and pressure experiments with common rock-forming minerals usually require sophisticated apparatus and techniques, with results not very obvious. Three simplified experiments restricted to atmospheric pressure and accessible temperature, using equipment easy to borrow, are presented for use in an introductory geology course. Carbon tetrachloride seems an unlikely substance to investigate, but its changes of state can be observed visually as well as by measurements. For melting relations of mixtures, the phases of lead bismuth alloys can be measured in a small crucible in an electric furnace. A more difficult

experiment, alpha–beta quartz transition, can be done by differential thermal analysis.—GDC

05706 **Elliot, Charles L.** Free world mining geophysical expenditures up 29 percent in 1966: Mining Eng., v. 19, no. 11, p. 75–76, illus., 1967.

Worldwide utilization of mining geophysics in 1966, based on questionnaires returned to the Society of Exploration Geophysicists, reached a new all time high with total expenditures of 25.7 million dollars, up 29 percent from 1965. This total was divided (in percent) as follows: ground surveys 63 (up 67), airborne surveys 27 (down 10), research 10 (up 6). Industry accounted for 81 percent of the total; government institutions, 19 percent. An increased use of induced polarization, electromagnetic, radioactivity, gravity, geothermal, drill-hole logging, and airborne magnetic and radioactivity methods were noted. Resistivity, earth current, magnetic, seismic, and airborne electromagnetic methods were used at about the same level, while use of the self-potential method noticeably decreased.—MAC

Ellison, Robert L. *See* Christensen, John T. 05674

05675 **Elvers, D. H.; deRosset, W. H.; Emery, W. M.** Detailed gravity and magnetic surveys of Mole Hill, Rockingham County, Virginia [abs.]: Virginia Jour. Sci., v. 18, no. 4, p. 185, 1967.

Emery, P. A. *See* Keech, C. F. 05864

Emery, W. M. *See* Elvers, D. H. 05675

05550 **Emigh, G. Donald.** Origin of phosphate in the Phosphoria Formation, *in* Industrial seminar, western phosphate region, 1966, Proc.: Montana Bur. Mines and Geology Spec. Pub. 42, p. 39–41, 1967.

The phosphate in the Phosphoria Formation is in small ovoid pellets. They are anisotropic petrographically, and are layered in beds and laminae mixed with detrital material and dolomite; all pellets contain varying amounts of foreign material. Five types of pellets are described, the nodule form being predominant; they are phosphatized calcium carbonate structures originally formed on the sea floor by the movement of ocean currents, not unlike those forming today in the Bahama Islands.—HRC

05617 **Emigh, G. Donald.** Petrology and origin of phosphorites, *in* Anatomy of the western phosphate field—Intermountain Assoc. Geologists, 15th Ann. Field Conf. 1967: Salt Lake City, Utah, Intermountain Assoc. Geologists, p. 103–114, illus., 1967.

All phosphate pellets are phosphatized calcium carbonate structures originally formed on the sea floor under the movement of ocean currents. The more highly phosphatized beds were formed under the following conditions: (1) below the euphotic zone, (2) relatively slight precipitation of calcium carbonate, (3) slow accumulation of organic and inorganic detrital material, (4) ocean currents to form pellets and renew solution, (5) long periods of time. Photomicrographs of Phosphoria phosphorites of southeast Idaho–Montana are included.—KAS

05926 **Engel, Paul L.; Swain, Frederick M.** Environmental relationships of Recent Ostracoda in Mesquite, Aransas and Copano Bays, Texas Gulf coast, *in* Symposium on the geological history of the Gulf of Mexico, Antillean–Caribbean region: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 408–427, illus., table, 1967.

Ostracoda from approximately 100 stations in Mesquite, Aransas and Copano Bays, St. Joseph Island and nearby open Gulf of Mexico represent about 50 species distributed in three principal biofacies:(1) subtropical lake, pond, and river biofacies with a prodelta subfacies; (2) shallow subtropical bay biofacies; (3) open shallow and subtropical open shelf biofacies. A statistical analysis of Ostracoda from Mesquite Bay suggests that some species are more adaptable than others to environmental changes in the bay. Some of the species of this assemblage range back as far as the Miocene and general similarities of environmental distribution

of latw Tertiary and Quaternary ostracode faunas and Recent assemblages are indicated by the study.—Authors' abstract

00145 **England, C. B.; Onstad, C. A.** Isolation and characterization of hydrologic response units within agricultural watersheds: Water Resources Research, v. 4, no. 1, p. 73–77, illus., table, 1968.

To extrapolate hydrologic relations from small to large areas, a watershed can be partitioned by isolation of units of relative homogeneity with respect to soil type, landform, and land use that fall into a sequence compatible with the hydraulics of overland and subsurface flows. In basins where lithology is relatively uniform, processes of landform development and soil genesis are closely related. Degree of slope, topographic position, and water balance of a site affect the kind of soil and its land-use capability,. Hydrologic response units within complex watersheds are based upon areal and elevational distribution of soils as delineated on a hypsometric curve.—Authors' abstract

Epstein, Anita G. *See* Epstein, Jack B. 05861

05861 **Epstein, Jack B.; Epstein, Anita G.** Geology in the region of the Delaware to Lehigh water gaps—Field Conf. Pennsylvania Geologists, 32d Ann., 1967, Guidebook: Harrisburg, Pa., Bur. Topog. and Geol. Survey, 96 p., illus., tables, 1967.

This field conference is designed to demonstrate the interrelationship of the stratigraphy, structure, geomorphology, glacial geology, and economic geology of Middle Ordovician through part of the Middle Devonian strata and overlying surficial deposits in the area. Facies relations, correlations between rocks in the eastern and western parts of the area, and the environmental conditions under which they were deposited are examined. Folds produced in these rocks are disharmonic; it is believed that each rock sequence is set off from those above and below by a decollement, or zone of detachment. Movement was northwest into the Appalachian basin, primarily by gravitational sliding, aided by directed tectonic forces.—MST

Erickson, Ralph. *See* Wells, J. D. 05717

05643 **Ericson, David B.; Wollin, Goesta.** The ever-changing sea: New York Alfred A. Knopf, 354 p., illus., 1967.

The eleven chapter headings are: the immense sea (origin of the Earth and ocean basins, continental drift, and descriptions of early exploration), circulation of the ocean, waves of the ocean (including tsunamis), ever-changing sea levels (includes isostasy and convection currents to explain early high levels), face of the Earth beneath the sea (includes a history of sounding methods), sediment carpet, deep sea and ice ages, crust beneath the ocean bottom (includes a biography of Maurice Ewing and geophysical methods of study), the Mohole, life in great depths, and the ocean and the future.—ESL

Ern, E. H. *See* Henika, W. S. 05678

Ern, Ernest H. *See* Plaster, Roger W. 05683

05638 **Esler, James E.; Preston, Floyd W.** FORTRAN IV program for the GE 625 to compute the power spectrum of geological surfaces: Kansas Geol. Survey Computer Contr. 16, 23 p., illus., table, 1967.

The two-dimensional power spectrum can be used for numerical description of landforms, and possibly their classification. The mathematical method is Fourier transform and autocorrelation function. The program consists of a mainline routine, PSMAIN, which reads raw data and processes it, and subroutines PS and PLOT. PS levels the data if necessary, and computes autocorrelation functions and power spectra, and produces punched or printed output. Printed output is plotted by subroutine PLOT, which can be called by PS OR PSMAIN. FORTRAN IV statements in a power-spectrum program are listed, and tables give sample data

and power spectra for SWOP data set 2A numerical listing. A small topographic map is shown of part of the Lone Star quadrangle, Kansas, contoured by computer and manually.—ESL

05823 **Eugster, O.; Eberhardt, P.; Geiss, J.** Krypton and xenon isotopic composition in three carbonaceous chondrites: Earth and Planetary Sci. Letters, v. 3, no. 3, p. 249–257, 1967.

The concentrations and isotopic composition of Kr and Xe have been measured in the three carbonaceous chondrites—Cold Bokkeveld, Lancé, and Orgueil. Spallation corrections and, in the case of Cold Bokkeveld also neutron effects, are negligible, and for the average Kr and Xe isotopic composition in carbonaceous chondrites various ratios between the krypton isotopes and the xenon isotopes are obtained. The significance and possible origin of the anomalies are discussed briefly.—*from* Authors' abstract

05608 **Evans, John Keith.** Depositional environment of a Pennsylvanian black shale (Heebner) in Kansas and adjacent states [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1990B, 1967.

05565 **Evitt, William R.** Progress in the study of fossil *Gymnodinium* (Dinophyceae): Rev. Palaeobotany and Palynology, v. 2, nos. 1–4, p. 355–363, illus., 1967.

Preliminary results of the study of over 1,000 samples from various parts of the world, including the United States, are given. Of the 25 species, none have been described. Important characters are an apical opening (archeopyle) and minute wall canals. Interspecifically variable characters are, besides size and outline, the surface ornamentation, distribution and orientation of canal walls, and size of the archeopyle. Equivocal evidence on the nature of the fossils remains (remains of cysts or of motile cells) is discussed.—*from* Author's summary

05448 **Ewart, A.** Water pressures during differentiation and crystallization of some ash-flow magmas from southern Nevada [discussion of paper by P. W. Lipman, 1966]: Am. Jour. Sci., v. 265, no. 10, p. 898–904, illus., table, 1967.

Alkali analyses of coexisting pumice and obsidian fragments from Taupo pumice sheets, New Zealand, do not show selective loss of sodium during hydration, as was suggested by Lipman. An additional method of estimating water pressure during crystallization, using data from New Zealand ignimbrites, is suggested.—MHK

05919 **Ewing, John.** Diapirs in the southwestern Gulf of Mexico [abs.], *in* Symposium on the geological history of the Gulf of Mexico, Antillean–Caribbean region: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 482, 1967.

Felder, Wilson N. *See* Christensen, John T. 05674

05609 **Feldmann, Rodney M.** Bivalvia and paleoecology of the Fox Hills Formation (Upper Cretaceous) of North Dakota [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1990B, 1967.

05838 **Felix, Charles J.; Burbridge, Patricia Parks.** Palynology of the Springer Formation of southern Oklahoma, U.S.A.: Palaeontology, v. 10, no. 3, p. 349–425, illus., 1967.

An exposure in Johnson County, Oklahoma, is studied. The microflora is transitional, with Mississippian and Pennsylvanian spores present, and is a transgressive facies from the Mississippian Goddard Formation to the Pennsylvanian Morrow Formation in the area. Descriptions and illustrations of 104 microspores are given. Seven new genera and 35 new species are included. The new genera are: *Costatacyclus, Cystoptychus, Hadrohercos, Nexuosisporites, Tantillus, Trochospora,* and *Scutulum.*—*from* Authors' abstract

Fenton, Gray. *See* Yeck, Ronald D. 00160

00095 **Feray, Dan E.** Nature of margins of sedimentary basins [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 52, no. 1, p. 198, 1968; Shale Shaker, v. 18, no. 5, p. 100, 1968.

Ferguson, George E. *See* Vice, Raymond B. 00056

Ferm, John C. *See* Dolan, Robert. 00122

Fields, E. D. *See* Sayers, R. W. 05712

05559 **Filloux, Jean Henri.** Oceanic electric currents, geomagnetic variations and the deep electrical conductivity structure of the ocean–continent transition of central California [abs.] Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 2004B, 1967.

05909 **Filson, John; McEvilly, Thomas V.** Love wave spectra and the mechanism of the 1966 Parkfield sequence: Seismol. Soc. America Bull., v. 57, no. 6, p. 1245–1257, illus., tables, 1967.

The Love-wave spectrums of five shocks of the 1966 Parkfield (California) sequence have been studied for evidence of source propagation. The modulation effect of propagation on the amplitude spectrum is described. The amplitude spectrum of the largest shock (M = 5.5) shows sharp minimums at periods where the spectrums of the other four shocks are relatively smooth; considered individually, these minimums are consistent with a fault rupture length of about 30 km and a rupture velocity of 2.2 kmps. Similarity in the shape of the spectrums of the four smaller events suggests similar focal dimensions. There is an unresolved ambiguity in rupture velocity/fault length.—DBV

Findlay, D. C. *See* Smith, C. H. 05879

Findlay, D. C. *See* Smith, C. H. 05880

Fireman, E. L. *See* McCorkell, R. 05960

05947 **Fisher, W. L.; McGowen, J. H.** Depositional systems in the Wilcox Group of Texas and their relationship to occurrence of oil and gas: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 105–125, illus., 1967.

Seven depositional systems occur: (1) Mt. Pleasant Fluvial system, updip and in outcrop,(2) Rockdale Dale system, primarily subsurface, (3) Pendleton Lagoon–Bay system, in outcrop and subsurface, (4) San Marcos Strandplain–Bay system, in outcrop and subsurface, (5) Cotulla Barrier Bar system, in the subsurface of south Texas, (6) Indio Bay–Lagoon system, updip and in outcrop, and (7) the South Texas Shelf system, in the subsurface of south Texas. The Rockdale is thickest, most extensive, and grades updip to the Mt. Pleasant. Rockdale sediments were also a source for later sedimentation elsewhere. The recognition of these facies permits establishing regional oil and gas trends.—*from* Authors' abstract

00165 **Flawn, Peter T.** The environmental geologist and the body politic: Prof. Geologist, v. 5, no. 1, p. 5–7, 1968.

The term environmental geologist is used to include all geologists directly concerned with society's use of the Earth, Earth's limitations and capacities, and resources and processes. When an environmental geologic report has been prepared, it should be explained in conference with planning agencies and engineering departments. Geologists have incurred the wrath of landowners or developers by appraising their land as hazardous for construction. A small group of scientists and engineers can work most effectively through a professional association, but the national geological societies have shunned the political arena. This is changing now, because we are dealing with too many irreversible environmental reactions.—ESL

05610 **Flemal, Ronald Charles.** Sedimentology of the Sespe Formation, southwestern California [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1991B, 1967.

05660 **Ford, Norman L.; Murray, Bertram G., Jr.** Fossil owls from the Hagerman local fauna (Upper Pliocene) of Idaho: Auk, v. 84, no. 1, p. 115–117, illus., table, 1967.

Among the several hundred avian fossils recovered from 1962 to 1965 from the Glenns Ferry Formation near Hagerman, Idaho, are four specimens of owls (Strigidae). Fragments of long bones of *Asio brevipes* n. sp., *Speotyto megalopeza* Ford, and two unidentified specimens possibly representing *Otus asio* are described. All birds reported previously from this fauna are aquatic forms, as are most of the birds in the present collection.—VMJ

Foster, Helen L. *See* Holmes, G. William. 00035

00147 **Fox, Sidney.** How did life begin?: Science and Technology, no. 74, p. 51–52, 55–56, 58–61, illus., 1968.

Billions of years ago life arose on Earth from lifeless chemicals. Most laboratories have assumed that the initial processes occurred spontaneously in a series of steps by which simple compounds were made more complex and finally self-organized into an early form of life. In attempting to duplicate the processes, laboratory experiments can be tested against effects of geological conditions. Amino acids, which can be [illegible] spontaneously from gases by heating without water, can be assembled [illegible] acids; upon adding water these self-assemble into microspheres like the living cells of today. The microspheres and their laboratory studies are a microcosm of chemical evolution, which may be creating life somewhere today.—GDC

05928 **Frazier, David E.** Recent deltaic deposits of the Mississippi River—Their development and chronology, *in* Symposium on the geological history of the Gulf of Mexico, Antillean-Caribbean region: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 287–315, illus., tables, 1967.

Sixteen deltaic lobes are detected in 6,000 years' formation; fourteen are in the Teche, St. Bernard, and LaFourche complexes, the last two in the modern birdfoot. The lobes are defined by cores, combined with lithologic and faunal data. Each lobe, related to a former course of the river, has a lower, fine-grained prodelta facies, a middle sandy delta front facies, and an upper fine-grained delta plain facies, including peat. Radiocarbon dates on the peat show the chronology of the sixteen lobes; their formation was not continuous. Similar sequences, common in the Tertiary, outcrop along the northern flank of the Gulf, and extend gulfward as massive clastic wedges.—*from* Author's abstract

05952 **Fredriksson, Kurt; Mason, Brian.** The Shaw meteorite, *in* Meteorites and tektites: Geochim. et Cosmochim. Acta, v. 31, no. 10, p. 1705–1709, illus., tables, 1967.

Shaw is an unusual meteorite, having chondritic composition but lacking chondritic structure. It consists largely of olivine and orthopyroxene with minor amounts of diopside, plagioclase, troilite, and nickel-iron. The chemical analysis is Fe 1.76, Ni 0.80, FeS 3.95, SiO_2 42.23, TiO_2 0.13, Al_2O_3 2.21, Cr_2O_3 0.28, Fe_2O_3 2.78, FeO 13.65, MnO 0.34, MgO 27.34, CaO 1.79, Na_2O 0.99, K_2O 0.10, P_2O_5 0.22, H_2O 0.89, H_2O 0.15. The calcium content of the orthopyroxene and the diopside suggests an unusually high temperature of crystallization, probably above 1100°C.—*from* Authors' abstract

00114 **Fridel, R. A.; Nalwalk, A. J.** Characterization of carbonaceous material from the Puerto Rico Trench of the Atlantic Ocean: Nature, v. 217, no. 5126, p. 345–347, illus., table, 1968.

Samples of two types of rocks containing organic material collected on the north wall of the Puerto Rico Trench at depths between 3,350 and 3,450 fathoms are the first organic samples obtained from depths of this magnitude. Pyridine and dioxane were used for extraction in organic studies. Ultraviolet and visible and infrared spectra were obtained from the original and extracted material. The infrared spectra indicate that the organic material is more similar to kerogen from oil shale than petroleum or coal. The visible spectra is similar to that of phenophytin *a*, a chlorin which is a degradation product of chlorophyll *a* formed by the simple

loss of magnesium. This indicates that the organic material in the samples is closely related to degradation products of plants, rather than animals.—KAS

Friedel, Robert A. *See* Lefelhocz, John F. 05922

05611 **Frimpter, Michael Howard.** Geology of the Thiells quadrangle, New York, with emphasis on the igneous and metamorphic rocks [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1991B–1992B, 1967.

Fujii, Naoyuki. *See* Kanamori, Hiroo. 00060

Gagné, R. M. *See* Hobson, George D. 05744

05670 **Galbreath, Edwin C.** A large *Bison occidentalis* from South Dakota: Illinois Acad. Sci. Trans., v. 60, no. 4, p. 436–437, illus., 1967.

Data and dimensions pertaining to the horns and skull of a bison found in 1960 in the bank of Spring Creek near Herreid, Campbell County, are presented. The specimen, well-preserved and solid, can be described as a set of unusually large horns on a larger than average skull of *Bison occidentalis*, based on fossil criteria set forth by Skinner and Kaisen (1947). The individual age, sexual dimorphism, and geologic age are not given.—GDC

00101 **Galley, John E.** Some tectonic principles in Permian basin of Texas and New Mexico [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 52, no. 1, p. 195, 1968; Shale Shaker, v. 18, no. 5, p. 98, 1968.

00109 **Gallup, W. B.** West Canadian Arctic our next oil province?: Oilweek, v. 18, no. 47, p. 10–12, 34, illus., 1968.

This basin, a subprovince of the West Canadian basin, is underlain by at least 600,000 cu mi of marine sedimentary rocks, 150,000 of them petroliferous. Formations considered as exploration targets are: Silurian Niagaran reefs formed along the flanks of ancient highs; the Ramparts Formation, Middle Devonian, consisting of porous limestones; the overlying bituminous Fort Creek Formation, a shale with reefs in the lower part; the Upper Devonian Melville Island Formation on Banks Island, with sands lying on reefs; and in the Mackenzie Delta graben, a Mesozoic reservoir with possible pinchouts which form traps.—ESL

05729 **Ganapathy, R.; Kuroda, P. K.** Mass-yield distribution of the iodine isotopes from the spontaneous fission of plutonium-242 and the existence of plutonium-244 in the early solar system: Earth and Planetary Sci. Letters, v. 3, no. 1, p. 89–93, illus., tables, 1967.

Cumulative fission yields for the mass chain A = 131–135 have been measured radiochemically with the following results: A = 131, 1.0 percent (reference standard); 132, 5.0±0.7 percent; 133, 5.3±0.7 percent; 134, 6.7±1.0 percent; 135, 4.9±0.8 percent. The general pattern is similar to that from the thermal neutron-induced fission of Pu-241, although the relative yields at mass numbers 132 and 134 appear to be slightly higher in the former. The mass-yield distribution of the "excess" heavy xenon isotopes observed in some meteorites show a remarkable resemblance to the shapes of the mass yield curves from the spontaneous fission of U-238 and Pu-242. These results are in agreement with the suggestion that the excess heavy xenon isotopes found in meteorites are the decay products of the "extinct" nuclide Pu-244.—*from* Authors' abstract

05846 **Garner, H. F.** Moorefield-Batesville stratigraphy and sedimentation in Arkansas: Geol. Soc. America Bull., v. 78, no. 10, p. 1233–1246, illus., 1967.

The oldest Mississippian strata above the Boone Formation in northern Arkansas carry a *Goniatites* s.s. fauna. Of the half dozen formation names used for these beds, only Moorefield and Batesville are widely applicable. The rock units to which these formation names are applied compose the lower shale unit (Moorefield Formation) and the overlying sandstone unit (Batesville Formation) of an interstratified and intertongued carbonate reef-terrigenous clastic deposit. The

present study outlines areas in which each lithic unit can be mapped, and delineates areas of mixed lithofacies (shale–limestone in the subsurface, sandstone–limestone in northwestern Arkansas, sandstone–shale in north-central Arkansas). Post Boone warping, uplift, and probable faulting formed the tectonic setting of Moorefield–Batesville sedimentation.—ATO

05780 **Garrels, Robert M.; MacKenzie, Fred T.** Origin of the chemical compositions of some springs and lakes, [Chap.] 10 *in* Equilibrium concepts in natural water systems—Am. Chem. Soc., 151st Ann. Mtg., Pittsburgh, 1966, Div. Water, Air and Waste Chemistry Symposium: Washington, D.C., Am. Chem. Soc. (Adv. Chemistry Ser. 67), p. 222–242, illus., tables, 1967.

The spring waters of the Sierra Nevada result from the attack of high CO_2 soil waters on typical igneous rocks and hence can be regarded as nearly ideal samples of a major water type. Their compositions are consistent with a model in which the primary rock-forming silicates are altered in a closed system to soil minerals plus a solution in steady-state equilibrium with these minerals. Isolation of Sierra waters from the solid alteration products followed by isothermal evaporation in equilibrium with the Earth's atmosphere should produce a highly alkaline Na HCO_3–CO_3 water; a soda lake with calcium carbonate, magnesium hydroxysilicate, and amorphous silica as precipitates.—Authors' abstract

Garrett, A. A. *See* Hidaka, F. T. 05855

05786 **Gaskell, T. F.** Introduction, Chap. 1 *in* The Earth's mantle (T. F. Gaskell, editor): London and New York, Academic Press, p. 1–9, 1967.

Exploration of the Earth's interior, especially the outermost 1,000 km, is undergoing a renewed phase of activity on an international and interdisciplinary basis known as the Upper Mantle Project. This text contains 16 (cited separately) review articles by experts in various fields related to the upper mantle that are intended to summarize currently available information, and to indicate the directions in which research is proceeding.—JPF

Gaston, H. H., Jr. *See* Thornton, Dewey E. 00069

Gees, R. A. *See* Lyall, Anil K. 05691

Geiss, J. *See* Eugster, O. 05823

05839 **Gentile, Richard J.** Mineral commodities of Macon and Randolph Counties: Missouri Div. Geol. Survey and Water Resources Rept. Inv. 40, 106 p., illus., tables, 1967.

Coal is the most valuable mineral resource in Macon and Randolph Counties, Mo.; limestone is second to coal; other mineral resources are ground water, sand, clay, shale, and conglomerate. In describing the nature, areal extent, and possible use of the mineral resources, special emphasis has been put on coal, found chiefly in Pennsylvanian strata. A composite stratigraphic section of outcropping rocks, a mineral commodity map, and measured stratigraphic sections of coal and limestone beds are included. Glacial drift overlies the Pennsylvanian strata everywhere except in two limited areas where larger streams have exposed Mississippian rocks. Wells over 500 feet deep have bottomed in rocks of Ordovician, Cambrian, and Precambrian(?) age. Ground water is highly mineralized.—GDC

05857 **Geological Society of Iowa.** Osage and Kinderhook Series, Des Moines County, Iowa—[Field trip] June 3, 1967: [Iowa City] Geol. Soc. Iowa, 10 p., illus., 1967.

The purpose of the trip was to view the type sections of members of the Burlington Limestone, and evidence for a regional unconformity at its base; to view the Kinderhook Series, and observe variations within the North Hill Group; and to observe the Devonian–Mississippian boundary. The Iowa Geological Survey places this boundary at the base of the North Hill Group. Six sections, three of them type sections, are included along with the road log and description of the formations.—ESL

05858 **Geological Society of Iowa.** Field trip, U.S. Gypsum Company, Sperry, Iowa, June 2, 1967: [Iowa City] Geol. Soc. Iowa, 7 p., illus., 1967.

The Devonian–Mississippian stratigraphy and structure of this area near the Mississippi arch are reviewed. Doubly-plunging anticlines and synclines are superimposed on regional structure, and the mine is on one of these anticlines. The gypsum bed occurs 610 feet below the surface in the Spring Grove Member of the Middle Devonian Wapsipinicon Formation; it is about 4.5 m thick, and separated into two units by a thin carbonate layer. The upper unit has lenses of black dolomite, satinspar, and anhydrite; the lower contains anhydrite lenses; these are described in detail. Studies indicate that anhydrite was replaced by gypsum.—ESL

05548 **Gere, W. C.** Phosphate deposits in Utah and Nevada, *in* Industrial seminar, western phosphate region, 1966, Proc.: Montana Bur. Mines and Geology Spec. Pub. 42, p. 21–29, illus., 1967.

Phosphatic shale occurs at the base of the Mississippian Deseret Formation and within the Brazer Formation throughout eastern Utah, although it is only potentially commercial near Laketown and Tintic. Small amounts also occur locally in other stratigraphic and geographic positions; the complex stratigraphic interweaving of several Permian formations is described. The phosphate occurs primarily in the Meade Peak Member of the Phosphoria Formation, and is, in decreasing order, in pellets and nodules, fossils and fossil fragments, oolites and pisolites, and cementing material. Almost 5 billion tons remain in reserves, in rocks in which the P_2O_5 content is more than 18 percent.—HRC

Gerrard, Charles M. *See* Parkin, Alan K. 00128

05656 **Gibson, Thomas G.; Schlee, John.** Sediments and fossiliferous rocks from the eastern side of the Tongue of the Ocean, Bahamas: Deep-Sea Research, v. 14, no. 6, p. 691–702, illus., 1967.

In August 1966, two dives were made with the deep-diving submersible *Alvin* along the eastern side of the Tongue of the Ocean to sample the rock and sediment. Physiographically, the area is marked by steep slopes of silty carbonate sediment and precipitous rock cliffs dusted by carbonate debris. Three rocks, obtained from the lower and middle side of the canyon (914–1676 m depth), are late Miocene–early Pliocene to late Pleistocene–Recent in age; all are deep-water pelagic limestones. They show (1) that the Tongue of the Ocean has been a deep-water area at least back into the Miocene, and (2) that much shallow-water detritus has been swept off neighbouring banks to be incorporated with the deep-water fauna in the sediments.—Authors' abstract

05612 **Gilmour, Ernest Henry.** Carbonate petrology and paleontology of the Alaska Bench Formation, central Montana [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1992B, 1967.

Ginsburg, Robert N. *See* Traverse, Alfred. 05819

Goldstein, Joseph I. *See* Buseck, Peter R. 00118

05655 **Goodman, Nelson.** Uniformity and simplicity, *in* Uniformity and simplicity—A symposium on the principle of the uniformity of nature: Geol. Soc. America Spec. Paper 89, p. 93–99, 1967.

The author is concerned with what meaning, if any, the Principle of Uniformity and the issue over uniformitarianism have for the geologist today. Past prominence by no means implies present pertinence. The conclusion is made that the Principle of Uniformity dissolves into a principle of simplicity that is not peculiar to geology but pervading all science and daily life. The geologist works under no uncommon handicaps and enjoys no special privileges merely because his work may be historical or descriptive.—MST

05676 **Goodwin, Bruce K.; Johnson, Gerald H.** Geologic structures and stratigraphy of a portion of the Triassic basin at Deep Run, Henrico County, Virginia [abs.]: Virginia Jour. Sci., v. 18, no. 4, p. 185, 1967.

Goodwin, Bruce K. *See* Johnson, Gerald H. 05679

05693 **Grant, A. C.** A continuous seismic profile from Halifax Harbour, Nova Scotia: Maritime Sediments, v. 3, nos. 2–3, p. 64, illus., 1967.

Fifteen seismic profiles were run immediately to the north of George Island in Halifax Harbour in conjunction with a hydrographic survey. A cross section prepared from a representative profile is given. Four sub-bottom units indicated are: soft mud, sand and silt, till, and bedrock. The sand and silt layer is stratified, and its surface is smooth as compared to the rough surface of the till. The flat-bottomed channel was probably scoured by the glacier, and partially filled with till in which a stream channel was cut and later filled with sand and silt. The mud blanket is modern.—ESL

05701 **Green, D. H.; Ringwood, A. E.** The stability fields of aluminous pyroxene peridotite and garnet peridotite and their relevance in upper mantle structure: Earth and Planetary Sci. Letters, v. 3, no. 2, p. 151–160, illus., tables, 1967.

Garnet at high pressures in pyrolites results from (1) spinel+orthopyroxene⇌olivine+garnet, or (2) Al pyroxene⇌gaarnet+low Al pyroxene. Spinel is sensitive to temperature and bulk composition. Spinel is absent above 1300°C in pyrolite, and garnet first appears because of (2). Garnet does not appear below 31.5 kb. At temperatures below 1300°C, garnet appears from 21 to 24 kb by (1) at the expense of spinel, and depends upon the Al. The Al_2O_3 decreases in the pyroxenes. Therefore, seismic velocity variations in oceanic upper mantle in pyrolite occur in two low velocity channels, both strongly influenced by mineralogical zoning in the upper mantle.—*from* Authors' abstract

05920 **Green, E. J.** The stability of aragonite in seawater—Thermodynamic influence of strontium: Geochim. et Cosmochim. Acta, v. 31, no. 12, p. 2445–2448, table, 1967.

Measurements of the distribution coefficient in the system strontianite-aragonite over a range of compositions allow the determination of the activity coefficients of both components in the system by application of the Gibbs–Duhem relation. It is concluded that the prevalence and long term persistence of aragonite in the oceans should be attributed to factors other than thermodynamic stabilization by coprecipitation with strontianite.—Author's abstract

Greene, Gordon W. *See* Moxham, Robert M. 05707

05847 **Gresens, Randall L.** Tectonic-hydrothermal pegmatites—[Pt.] 2, An example: Contr. Mineralogy and Petrology, v. 16, no. 1, p. 1–28, illus., tables, 1967.

The Kiawa pegmatites, New Mexico, are thought to have formed in low pressure zones by the reaction, quartz+muscovite+(Na+, K+) perthite $+H^+$ [for process, see Pt. 1, ibid., v. 15, p. 345–355, 1967; Abstracts N. Am. Geology, December 1967]. This reaction is supported by the following: occurrence of pegmatites in structurally low pressure zones, availability of quartz and muscovite as raw material before formation of the pegmatites, distribution of major and trace elements and presence of elements released by major reactions in minerals of pegmatites and country rocks, a distribution of barium as predicted, and geologic evidence of synkinematic formation during regional metamorphism.—VSN

05877 **Gresswell, R. Kay.** Physical geography: New York and Washington, Frederick A. Praeger, 504 p., illus., tables, 1967.

This book, written by a lecturer at the University of Liverpool, is divided into seven major parts: elements of meteorology, elements of climatology, weathering and rivers, ice and glaciation, coasts and the sea, volcanoes and volcanism, and soils and vegetation. Illustrations are mostly of foreign areas.—GDC

Griffiths, J. C. *See* Dahlberg, E. C. 05444

Grim, Paul J. *See* Burns, Robert E. 05970

05649 **Gross, M. Grant.** Oceanography: Columbus, Ohio, Charles E. Merrill Books (Merrill Phys. Sci. Ser.), 135 p., illus., tables, 1967.

The nine chapters are titled: the water planet (includes age and origin of sea water, and permanence of shorelines and basins); the ocean floor; deep-sea sediment; water and its properties; sea water, a salt solution; the open ocean; ocean currents; waves and tides; and shallow and coastal oceans. Each chapter concludes with questions and a list for supplementary reading.—ESL

05725 **Guild, Philip W.** Metallotects of North America [abs.]: Mining Eng., v. 19, no. 12, p. 33, 1967.

05979 **Guilday, John E.; Irving, David C.** Extinct Florida spectacled bear *Tremarctos floridanus* (Gidley) from central Tennessee: Natl. Speleol. Soc. Bull., v. 29, no. 4, p. 149–162, illus., tables, 1967.

An isolated skeleton of the extinct Florida spectacled bear, *Tremarctos floridanus* (Gidley), was found in a cave in Cumberland County, east-central Tennessee, on the east flank of Brady Mountain. This is the first record of this species from Tennessee, extending its range north and west from Florida and Georgia. The age of the skeleton is thought to be Illinoian to early postglacial. The animal died on essentially the present cave floor and was subsequently lightly covered with a caliche-like flowstone patina about 1 mm thick, implying wetter conditions at the time, probably in the early post-Pleistocene (c. 8,000 B.P.).—MST

05551 **Gulbrandsen, R. A.** (compiler). Selected references on the geology of phosphate deposits in the western states (post-1952), *in* Industrial seminar, western phosphate region, 1966, Proc.: Montana Bur. Mines and Geology Spec. Pub. 42, p. 81–82, 1967.

There are 64 references in this bibliography.—HRC

05479 **Gulbrandsen, Robert A.** Some compositional features of phosphorites of the Phosphoria Formation, *in* Anatomy of the western phosphate field—Intermountain Assoc. Geologists, 15th Ann. Field Conf. 1967: Salt Lake City, Utah, Intermountain Assoc. Geologists, p. 99–102, illus., tables, 1967.

Quartz, muscovite-illite, feldspar, iron oxide and organic matter are ubiquitous components of the Phosphoria phosphorites, in addition to apatite. The apatite is basically fluorapatite, with small but significant and variable substitutions. A table shows the chemical composition of some phosphorite types and the average phosphorite composition of the Retort and Meade Peak Phosphatic Shale Members and the Phosphoria Formation as a whole. Most of the rare metals in phosphorites of the Phosphoria Formation occur in association with either the organic matter component of the rock or the apatite.—KAS

05856 **Guthrie, Daniel A.** The mammalian fauna of the Lysite Member, Wind River Formation (early Eocene) of Wyoming: Southern California Acad. Sci. Mem., v. 5, 53 p., illus., tables, 1967.

The difficulty in recognizing faunas of Lysitean age has led to a review of the major collections of vertebrate remains from the Lysite Member of the Wind River Formation and to a renewal of collecting in the type area near Lysite, Wyo. These deposits are considered to represent only the upper fourth of Lysitean time. About 70 species of vertebrates have been recovered, 61 of which are mammals. Four new species are described: *Palaeanodon woodi*, an edentate; *Franimys lysitensis*, a rodent; *Prolimnocyon iudei*, a creodont; and *Miacis jepseni*, a carnivore. Twenty-three species are recorded in the Lysite for the first time and taxonomic changes are made in several early Eocene mammalian lineages.—*from* Author's abstract

Guy, Harold P. *See* Vice, Raymond B. 00056

05572 **Guzel, P. van.** Palynology and fluorescence microscopy: Rev. Palaeobotany and Palynology, v. 2, nos. 1–4, p. 49–79, illus., 1967.

Three principles determine primary fluorescence: (1) each type at each geological age has its own color, (2) for each type, the color changes with increasing age from the bluish-green to the orangish-red part of the spectrum, and (3) a relation exists between the fluorescent color and rank of coal of the embedding deposit. The final stage at increasing age and coalification is the complete extinction of fluorescence. Potential uses of this information are discussed.—HRC

05454 **Halbouty, Michel T.** Our responsbility in public affairs: Jour. Geol. Education, v. 15, no. 5, p. 205–208, 1967.

Political events are maneuvered and regulated by those who make it a point to participate in political action. Any professional man owes it to the public to use his stature, his intelligence and his prestige in public affairs. As a geologist and petroleum engineer, the author points an accusing finger at those in his own profession who have been negligent in this area. Dr. Lahee (1933) was one who warned of overdrilling petroleum reservoirs, and recognized the responsibility of geologists to inform the public of occurrence and conservation of natural resources. Professional organizations which have more weight with the public than do trade associations, could help in the dissemination of pertinent information.—GDC

05833 **Halbouty, Michel T.** Hidden trends and features: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 2–23, illus., 1967.

Hidden trends lie below unconformities, at undrilled depths in productive trends, and in relatively unexplored areas; they may be ancestral anticlines, domes, faults, stratigraphic traps, and buried geomorphic features. The Gulf Coastal Province contains many examples, such as sand pinchouts in the Frio Oligocene lagoons in Texas; buried structures and sand buildups in the Hackberry Embayment, Oligocene in Texas and Louisiana; localized favorable sands in the downdip Wilcox from Alabama to Mexico; undiscovered oil in traps around productive salt domes; and the entire Gulf Coast where possible buried geomorphologic features exist. Examples are described.—HRC

05461 **Hale, Lyle A.** (compiler). Composite bibliography—Western mineral resources, *in* Anatomy of the western phosphate field—Intermountain Assoc. Geologists, 15th Ann. Field Conf. 1967: Salt Lake City, Utah, Intermountain Assoc. Geologists, p. 275–283, illus., 1967.

Hale, Lyle A. *See* Intermountain Association of Geologists. 05480

05622 **Hale, Lyle A.** Phosphate exploration using gamma-radiation logs, Dry Valley, Idaho, *in* Anatomy of the western phosphate field—Intermountain Assoc. Geologists, 15th Ann. Field Conf. 1967: Salt Lake City, Utah, Intermountain Assoc. Geologists, p. 147–159, illus., 1967.

The close phosphate-radiation relationship is genetically related to the chemical affinity of calcium and uranium ions during precipitation of the phosphorite pellets. The close, if not directly proportional, relationship between phosphate grade and radiation intensity leads to the conclusion that, with more precise calibration techniques, gamma radiation logs can be locally used for quantitative determination and, in combination with other data, may shed additional light on conditions and processes of sedimentation.—*from* Author's abstract

Hall, John W. *See* Norton, Norman J. 05563

05552 **Hallam, Anthony.** The bearing of certain palaeozoogeographic data on continental drift: Palaeogeography, Palaeoclimatology, Palaeoecology, v. 3, no. 2, p. 201–241, illus., 1967.

Data on the distribution of land vertebrates and marine mollusks from Triassic to the present are discussed. Modern limiting factors are discussed, such as ocean basins being as effective boundaries as is land. Complementarity in distribution patterns in continental and marine faunas resulting from the emergence of land bridges is noted. Continental drift, the mechanism, did not occur until the Cretaceous although the North Atlantic could have opened a bit earlier. The best evidence so far comes from the North Pacific region and suggests that the Bering Land Bridge was established by Middle or Lower Cretaceous time.—*from* Author's summary

00046 **Halstead, Perry N.; Call, Richard D.; Rippere, Kenneth H.** Geologic structure analysis for open-pit slope design, Kimberly Pit, Ely, Nev. [abs.]: Mining Eng., v. 20, no. 1, p. 90–91, 1968.

Hammond, Edwin H. *See* Trewartha, Glenn T. 05614

05764 **Hansen, Wallace R.** The lower Black Canyon of the Gunnison: Natl. Parks Mag., v. 41, no. 238, p. 14–19, illus., 1967.

Geologic history of the lower section of the Black Canyon of the Gunnison River (north of the national monument) in west-central Colorado is outlined in a semipopular account. Entrenchment of the river has exposed an excellent geologic section of Mesozoic strata unconformably overlying the Precambrian basement of the Gunnison uplift. Structurally and topographically the lower canyon is dominated by the Ute Indian fault zone, a north-trending line of fractures along which the Precambrian granodiorite was thrust over the younger rocks. Laterally, and in part vertically, the faults pass into monoclines. Flowage and other deformational features of the Precambrian and younger rocks are clearly exposed.—VMJ

Harding, Samuel T. *See* Algermissen, S. T. 05903

05800 **Harper, C. T.** On the interpretation of potassium-argon ages from the Precambrian shields and Phanerozoic orogens: Earth and Planetary Sci. Letters, v. 3, no. 2, p. 128–132, illus., table, 1967.

Radiometric evidence for orogenesis is preserved only in the uppermost part of the continental crust, and is readily lost through erosion. The deep erosion suffered by exposed Precambrian sections of the crust has effectively removed all of the K–Ar evidence of orogenesis in these older rocks. K–Ar ages from the Precambrian do not therefore refer to orogenic episodes, but are more correctly interpreted in terms of chelogenic processes involving uplift and stabilization of large blocks of the continental crust.—Author's conclusions

05472 **Harris, H. D.** Rotary air-drilling of phosphate deposits in southeastern Idaho, *in* Anatomy of the western phosphate field—Intermountain Assoc. Geologists, 15th Ann. Field Conf. 1967: Salt Lake City, Utah, Intermountain Assoc. Geologists, p. 167–171, illus., 1967.

A rapid, low-cost method of obtaining samples for the evaluation of phosphate deposits in southeastern Idaho is provided by the use of a truck-mounted rotary drill rig utilizing compressed air as the circulating media. The seismograph-type drilling rig commonly equipped for mud or air drilling is compact, fast, portable and is suited for operation in the rugged terrain in which the phosphate beds occur in southeastern Idaho. Air-derived cuttings represent a complete and relatively uncontaminated sample of the drilled interval within certain limitations discussed.—Author's summary

Harriss, Robert C. *See* Turekian, Karl K. 05770

05726 **Hartman, Ronald R.; Ackerman, J.** The airborne magnetic gradiometer [abs.]: Mining Eng., v. 19, no. 12, p. 35, 1967.

05465 **Hartshorn, Joseph H.** Geologic descriptions of USGS topographic maps—Ticonderoga quadrangle, New York-Vermont; Monadnock quadrangle, New

Hampshire; Kingston quadrangle, Rhode Island; Renovo West quadrangle, Pennsylvania: Jour. Geol. Education, v. 15, no. 5, p. 188–196, illus., 1967.

The brief geologic descriptions accompanying the first four of a set of 25 maps, in a group known as *A set of one hundred topographic maps illustrating specified physiographic features*, are given. This set of maps has been used for over a decade as an aid in describing the landforms and physiographic divisions of the United States. Geologic descriptions for the set are being prepared by members of the U.S. Geological Survey, and are addressed primarily to students and teachers who are not specialists in the topic or areas being covered. They may be useful also to professional geologists as reminders of the basic geologic framework of each quadrangle.—GDC

Harvey, A. H. *See* Moxham, Robert M. 05707

05625 **Haven, Dexter S.; Morales-Alamo, Reinaldo.** Aspects of biodeposition by oysters and other invertebrate filter feeders [abs.]: Virginia Jour. Sci., v. 18, no. 4, p. 160, 1967.

05677 **Haven, Dexter S.; Morales-Alamo, Reinaldo.** Occurrence and transport of fecal pellets in suspension in the James River, Virginia [abs.]: Virginia Jour. Sci., v. 18, no. 4, p. 185–186, 1967.

05571 **Havinga, A. J.** Palynology and pollen preservation: Rev. Palaeobotany and Palynology, v. 2, nos. 1–4, p. 81–98, illus., tables, 1967.

Laboratory and field experiments on pollen corrosion and decay were made. Differential susceptibility to chemical oxidation and microbial attacks in various soil types are described. An investigation of some fossil podsol profiles revealed the frequent occurrence of pollen with a perforated exine in some of them. The theory adduced is that the perforations originate mainly from a phase of soil formation, preceding the present profile, which had rich biological activity. The soil podsolized rapidly and then submerged, so that the corrosion phenomena were "fossilized".—*from* Author's summary

05923 **Hay, William W.; Mohler, Hans P.; Roth, Peter H.; Schmidt, Ronald R.; Boudreaux, Joseph E.** Calcareous nannoplankton zonation of the Cenozoic of the Gulf Coast and Caribbean-Antillean area, and transoceanic correlation, *in* Symposium on the geological history of the Gulf of Mexico, Antillean-Caribbean region: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 428–480, illus., 1967.

Evolution of calcareous nannoplankton was rapid in the Cenozoic; many forms are worldwide and so make good index fossils. Zones based upon genera and species are proposed for the various epochs in the Cenozoic, and these zones approximate the zones currently recognized based on planktonic foraminifera. Mesozoic floras were greatly reduced at the end of the Cretaceous but the volume of varieties recovered by middle Paleocene. Discoasters first appear in the middle Paleocene. Various groups are described as are many genera and species.—HRC

00123 **Hearn, B. Carter, Jr.** Diatremes with kimberlitic affinities in north-central Montana: Science, v. 159, no. 3815, p. 622–625, illus., 1968.

Diatremes in the Missouri River Breaks demonstrate systematic subsidence-ring structure, contain inclusions derived from far above and far below, and have been produced by gas-rich eruptions of alkalic ultramafic magmas. Similar magmas have produced diatremes in many localities in the world and are known to be closely associated with and probably parental to kimberlites.—Author's abstract

05885 **Heede, Burchard H.** The fusion of discontinuous gullies—A case study [with French abs.]: Internat. Assoc. Sci. Hydrology Bull., v. 12, no. 3, p. 42–50, illus., table, 1967.

This study demonstrates fusion of two discontinuous gullies in the Colorado Front Range and relates storms and flows to erosion events. In 7 years, only 5 storms produced runoff in a gully system in this Range. Storm intensities for periods of

10 minutes influenced runoff production; antecedent precipitation was of no benefit to forecast gully flows. Neither upstream progression of the head cut nor amounts of net erosion caused by individual flows could be related to storm parameters. Stability conditions changed with time but did not necessarily improve during shorter periods; at times, instability increased and set the stage for more intense future erosion. Applying results from gully-control studies, the author speculates that early nominal expenditure of funds would have prevented fusion of the gullies and displacement of all or most of the soil.—*from* Author's abstract

Heezen, Bruce C. *See* Johnson, G. Leonard. 05657

Heezen, Bruce C. *See* Ruddiman, William F. 05658

00088 **Heise, Horst.** Gas search needs pickup: Oilweek, v. 18, no. 49, p. 42–45, illus., tables, 1968.

Gas fields with more than 500 bcf of reserves and fields with Cretaceous reserves exceeding 100 bcf in Alberta are tabulated, including sources of reserves and their growth. Almost half the reserves occur in 18 fields, 17.9 tcf. Reserves in the Devonian, Mississippian, and Triassic–Cretaceous fields are reviewed. Misleading impressions regarding the association of Cretaceous fields with deeper production are discussed. Suggestions are made as to exploration in Alberta for Cretaceous reserves, sheet-type reservoirs in the Mississippian, and foothills trend, and in British Columbia in the unexplored foothills.—ESL

00074 **Hem, J. D.** Graphical methods for studies of aqueous aluminum hydroxide, fluoride, and sulfate complexes: U.S. Geol. Survey Water-Supply Paper 1827-B, p. B1–B33, illus., tables, 1968.

Published stability constants show that aluminum forms strong complexes with hydroxide, fluoride, and sulfate ions. Equilibrium calculations show that fluoride complexes probably will be the predominant form of aluminum solutes in natural water below neutral pH, when more than a few tenths of a part per million of fluoride is present. Sulfate complexes can be important below neutral pH if sulfate concentrations exceed 500 parts per million. By means of graphs, the predominant complex species and proportion of uncomplexed aluminum activity to total aluminum concentration are shown as functions of the analytical concentration of aluminum and fluoride, or sulfate, for ionic strengths ranging from zero to that of sea water, also forms which can be expected to predominate, and extent of complexing by both fluoride and sulfate, and effects of pH.—*from* Author's abstract

05742 **Henderson, C. M. B.** Analysis of standard silicate rocks: Earth and Planetary Sci. Letters, v. 3, no. 1, p. 1–7, tables, 1967.

It is suggested that before agreement between different laboratories for standard rock analyses can be further improved, standardized chemical methods should be widely accepted. A scheme for silicate rock and mineral analysis which is a compromise between classical and rapid methods is outlined. The precision and accuracy of the methods are estimated from replicate analyses of W-1. Standard rocks, Y-1, C. A. A. S. syenite, GA, GH, GR, and BR have also been analyzed in replicate and it is suggested that the proposed values for Na_2O in W-1, and FeO in GA, GH, GR, T-1, and C. A. A. S. syenite should be increased.—Author's abstract

05678 **Henika, W. S.; Ern, E. H.** Structural behavior of differentiated hornblende metagabbro injections in the central Piedmont, Virginia [abs.]: Virginia Jour. Sci., v. 18, no. 4, p. 186, 1967.

00102 **Henry, Gary E.** Recent developments in Marietta basin [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 52, no. 1, p. 196, 1968; Shale Shaker, v. 18, no. 5, p. 100, 1968.

Herbertson, John G. *See* Squarer, David. 00055

00136 **Hewett, D. F.** Silver in veins of hypogene manganese oxides: U.S. Geol. Survey Circ. 553, 9 p., illus., tables, 1968.

In intensive search for manganese during World Wars I and II, numerous veins of high-grade manganese oxides were discovered in the southwestern United States; their mode of origin was greatly speculated. More recent studies indicate that the manganese in the oxide minerals was derived from great depth, that the explored veins were formed near the original surface, and that, if explored in depth, they might be succeeded by deposits of barite, fluorite, and epithermal sulfide minerals of zinc, lead, and copper that are generally mined for their content of silver and gold. Recent explorations of a manganese-bearing vein of barite in Nova Scotia fortify these speculations, but to test it, drill holes will have to be cut to vein zones 500 to 1,000 feet below the present level of explorations.—*from* Author's abstract

Heyl, A. V. *See* Zartman, R. E. 05446

05721 **Heyl, Allen V.** The 38th parallel lineament and its relationship to ore deposits [abs.]: Mining Eng., v. 19, no. 12, p. 33, 1967.

05855 **Hidaka, F. T.; Garrett, A. A.** Evaluation of seepage from Chester Morse Lake and Masonry Pool, King County, Washington: U.S. Geol. Survey Water-Supply Paper 1839-J, p. J1-J26, illus., tables, 1967.

Geologic and hydrologic settings are summarized for the Cedar River and Snoqualmie River basins on the west slope of the Cascade Range. Topography is that of a youthful upland incised by steep-sided stream valleys. The area has been modified greatly by erosion and deposition associated with Pleistocene glaciations. Hydrologic data have been analyzed to determine the amount of water lost by underground seepage from Chester Morse Lake and Masonry Pool (reservoirs on the Cedar River, which is the source of municipal water supply for Seattle) to the Cedar River and South Fork Snoqualmie River. For water years 1957-64 average losses from the reservoirs were about 220 cfs, with average gains of about 180 cfs in the Cedar and 50 cfs in the South Fork Snoqualmie. Changes in runoff regimen due to the Boxley Creek washout in 1918 are analyzed also.—VMJ

05621 **Hignett, Travis P.** Outlook for the phosphate industry—A national and international view, *in* Anatomy of the western phosphate field—Intermountain Assoc. Geologists, 15th Ann. Field Conf. 1967: Salt Lake City, Utah, Intermountain Assoc. Geologists, p. 137-145, illus., tables, 1967.

Statistics are given for world and United States phosphate industry production and capacity. Predictions are made for the amount of phosphate fertilizer used in different parts of the United States for 1970 and 1980. The use of sulfuric acid, nitric acid, and electric furnaces in the processing of phosphate rock to a usable form is discussed.—KAS

00149 **Hill, J. V.** Carbonate study of a typical Silurian reef, Pt. 1: World Oil, v. 166, no. 1, p. 62-65; Pt. 2, ibid., no. 2, p. 57-61, illus., 1968.

Detailed study of cores from wells drilled through the Payne reef of Silurian age in southwestern Ontario, Canada, establishes a sequence of five phases of reef growth: (1) initiation of reef as a bank of crinoid debris; (2) establishment of an organic framework for the reef in shallow water by colonial algae; (3) accelerated vertical growth of reef, dominantly by sediment production and binding by algae on a subsiding sea floor, accompanied by slumping that produced reef breccia; (4) reduction of reef growth in shallow, more saline water with stromatoporoids as the only reef builders; and (5) growth only on margins of reef and deposition of fine-grained carbonates succeeded by evaporites in central lagoon. Illustrations depict the reef configuration and rock types characteristic of the growth phases.—MWR

Hill, R. D. *See* Bendixen, Thomas W. 00092

Hills, F. Allan. *See* Armstrong, Richard Lee. 05826

00134 **Hills, Sydney F.; Skermer, Nigel A.** Large scale testing of rockfill materials—Discussion [of paper 5128 by R. J. Marsal, 1967]: Am. Soc. Civil Engineers Proc., v. 94, paper 5704, Jour. Soil Mechanics and Found. Div., no. SM 1, p. 326–328, illus., 1968.

Marsal (ibid., v. 93, no. SM 2, p. 27–43, 1967) has developed a useful triaxial apparatus for testing shear strength and compressibility of rockfill materials for dams. Test results on the granitic gneiss are here discussed, considering the significant contribution of the membrane sand, which has a cross-sectional area of 17 percent of the entire sample. It is shown that the combined effects of an increase in axial load on the sand membrane and a reduction in radial stress transferred across the rockfill tend to be compensating, and with rockfill similar to the granitic gneiss, if the sand in the membrane is fairly loose before the start of shear testing, the effect on the strength of the rockfill may not be great. If the sand were less compressible than the rockfill, effective radial stress in the rock would be less than confining pressure, and the strength of the rockfill would be underestimated.—VMJ

05460 **Hite, R. J.** Geology of the Standard of California Dry Valley Unit Well No. 1, Caribou County, Idaho, *in* Anatomy of the western phosphate field—Intermountain Assoc. Geologists, 15th Ann. Field Conf. 1967: Salt Lake City, Utah, Intermountain Assoc. Geologists, p. 271–272, illus., 1967.

The geology of the Dry Valley Well is described briefly. A cross section shows the geology of the rocks penetrated in the well.—KAS

05744 **Hobson, George D.; Lee, Hulbert A.; Gagné, R. M.** Thickness of drift, Lebel, Gauthier, Boston and McElroy Townships, Ontario: Canada Geol. Survey Prelim. Ser. Map 11–1967, scale about 1 in. to 1/2 mi., 1967.

05848 **Hodgson, G. W.; Baker, B. L.; Peake, E.** The role of porphyrins in the geochemistry of petroleum [with French abs.], *in* Petroleum industry—General problems—World Petroleum Cong., 7th, Mexico, 1967, Proc., V. 9: London, Elsevier Publishing Co., p. 117–128, illus., tables, 1967.

Porphyrins and related pigments are good geochemical marker compounds in the genesis of petroleum. Porphyrins or chlorins, isoprenoids and perylenes exist in rocks of all ages and in modern plants, with porphyrins predominant in old rocks, chlorins in recent. Mass spectrometry reveals phyllo and etio homologous series of porphyrins and chlorins with mass ranges from about 408 to 504. A direct relationship exists between vanadyl porphyrins and sulfur in heavy petroleums. Separate origins for vanadyl and nickel porphyrins are indicated, with vanadyl coming from vanadyl chlorins of plants, and nickel from chlorophyll degradation products. The surface activity role of porphyrins and chlorins in oil field formation is uncertain.—*from* Authors' abstract

05809 **Hogberg, R. K.; Sloan, R. E.; Tufford, Sarah.** Guide to fossil collecting in Minnesota (revised edition): Minnesota Geol. Survey Educ. Ser. 1, 38 p., illus., geol. map, 1967; originally published 1965.

The original edition by Tufford is abstracted in Abstracts of North American Geology, May 1966.—MCM

05921 **Holm, J. L.; Kleppa, O. J.; Westrum, Edgar F., Jr.** Thermodynamics of polymorphic transformations in silica—Thermal properties from 5 to 1070°K and pressure-temperature stability fields for coesite and stishovite: Geochim. et Cosmochim. Acta, v. 31, no. 12, p. 2289–2307, illus., tables, 1967.

Cryogenic heat-capacity measurements on coesite and stishovite provide thermodynamic properties from 5° to 350°K. The heat capacities, entropies, and Gibbs energy functions are given for coesite and stishovite. Enthalpies of transition for phase changes (adjusted to 298.15°K) were: quartz coesite, 1.21±0.15; quartz cristobalite, 0.64±0.15; quartz silica glass, 2.15±0.15. The enthalpy of coesite to 1070°K and the enthalpy of transformation for stishovite silica glass were provided by means of a new technique, "transposed-temperature" drop calorimetry. The

P–T field phase boundaries delineated for the stable equilibrium coesite–quartz and coesite–stishovite and for the metastable quartz–stishovite boundary are in reasonable agreement with results of recent studies.—DBV

00035 **Holmes, G. William; Hopkins, David M.; Foster, Helen L.** Pingos in central Alaska: U.S. Geol. Survey Bull. 1241-H, p. H1–H40, illus., table, 1968.

Pingos are common, but enevenly and widely distributed in the discontinuous permafrost zone of Alaska; many occur at the base of south-facing slopes. Most are subrounded in plan and have microrelief features. Vegetation cover (forest or shrub) is adjusted to slope conditions and development. Growth may proceed from low, featureless mounds, to higher domes with cracks and trenches, to those with summit craters, ponds, springs, and landslide blocks, and finally to collapsed and second-generation pingos. Subarctic pingos are ground-water features (belonging to the open-system type) which probably are uplifted by both artesian and freezing pressures. These pingos are periglacial to present and Pleistocene glaciers. Limited geochronological data suggest they are products of the Recent climate.—GWH

00106 **Holmquest, Harold J., Jr.; Johansen, Robert T.; Smith, Harold M.** Introduction to composition and stratigraphy relationships of Permian basin oils, Texas and New Mexico [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 52, no. 1, p. 194, 1968; Shale Shaker, v. 18, no. 5, p. 101, 1968.

Holstein, H. J. *See* Williams, George A. 05475

05554 **Honkala, Fred S.** The Phosphoria Formation in Montana, *in* Industrial seminar, western phosphate region, 1966, Proc.: Montana Bur. Mines and Geology Spec. Pub. 42, p. 10–12, 1967.

Very brief, cursory descriptions are given of the Phosphoria Formation in Montana, and its associated and intertongued adjacent Park City and Shedhorn Formations. There are over 1.6 billion tons of rock with over 18 percent P_2O_5 in reserve.—HRC

05616 **Hope, E. R.** Comments of the translator, *in* A chart of the recent tectonics of the Arctic, by A. P. Puminov: Canada Defence Research Board Directorate Sci. Inf. Services [Rept.] T 487 R, p. 5–7, illus., 1967.

If the idea of the Lomonosov and Mendeleyev mountains as a single system, presumably folded, is correct, there should be evidence of an extension of the orogenic disturbance on the land masses at either end. The Mendeleyev ridge has been considered a horst lying within the ocean basin and not affecting the land masses. The Lomonosov ridge is not a dike or midocean ridge. If the European basin were closed, it would be juxtaposed with the edge of the north European shelf, so may represent one side of an axially rifted system. The Canada basin on the other side of the ridge exhibits a different magnetic pattern. The Sadko trough is about on the axial line of the European basin and may be an extension of the rift cutting into the continental rise. Translations of two excerpts from news items about the depth of the trench are included.—ESL

Hopkins, David M. *See* Holmes, G. William. 00035

00047 **Hopkins, David M.** Placer prospects in northern Bering Sea [abs.]: Mining Eng., v. 20, no. 1, p. 92, 1968.

05573 **Hopping, C. A.** Palynology and the oil industry: Rev. Palaeobotany and Palynology, v. 2, nos. 1–4, p. 23–48, illus., 1967.

The history and nature of palynology as an applied science in the oil industry is discussed fully. Examples of methods and problems in sample preparation, data processing, sporomorph translucency studies, recent sediments, and paleogeographic studies are given.—*from* Author's summary

05730 **Horn, David Russell.** Recent marine sediments and submarine topography, Sverdrup Islands, Canadian Arctic Archipelago [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1992B, 1967.

Horne, K. C., Jr. *See* Wiggins, L. B. 05696

05753 **Hoskins, Hartley.** Seismic reflection observations on the Atlantic continental shelf, slope, and rise southeast of New England: Jour. Geology, v. 75, no. 5, p. 598–611, illus., 1967.

Twenty-five reflection profiles across the outer shelf show three prograded units within the upper kilometer of sediment that dip gently seaward. The lowest unit (Upper Cretaceous) crops out on the slope, and is unconformably overlain either by the intermediate unit (middle to upper Tertiary) or by the uppermost unit (Pleistocene), which are as much as 0.7 and 0.1 km thick, respectively. The slope, whose surface dips 1–6°, is probably a degraded scarp formed between Late Cretaceous and mid-Tertiary time. The continental rise, whose surface dips less than 1 1/2°, is an apron of onlapping sediment as much as 1.6 km thick eroded from the shelf edge and slope. The ocean basin beneath the rise, slope, and the edge of the shelf has been depressed since the deposition of Upper Cretaceous sediments.—VES

05907 **Housner, G. W.; Trifunac, M. D.** Analysis of accelerograms—Parkfield earthquake: Seismol. Soc. America Bull., v. 57, no. 6, p. 1193–1220, illus., table, 1967.

Integrated velocities and displacements show that near the fault at Cholame the surface motion exhibited a transient horizontal displacement pulse of approximately 10 inches amplitude and 1 1/2 sec duration, normal to the fault. The ground motion attenuated rapidly with distance and at 10 miles from the fault the maximum acceleration was reduced to 1/10 of its near-fault value. With distance, ground motion lost its pulse-like directional characteristic and became isotropic. The large spectrum ordinates for this shock of relatively small magnitude and moderate destructiveness indicate that in an engineering sense the Parkfield ground motion is in a different class from such large destructive ground motions as El Centro 1940, Tehachapi 1952, and Olympia 1949.—*from* Authors' abstract

00164 **Howard, James W.** Water-level data from observation wells in the northwestern Gulf Coastal Plain of Texas: Texas Water Devel. Board Rept. 70, 209 p., illus., tables, 1968.

This report contains water-level data from observation wells in nine counties of the northwestern Gulf Coastal Plain, an area of about 10,000 square miles. It includes the heavily pumped Winter Garden irrigation district, and adjacent areas in which considerable water-level data have been gathered. The data are presented in the form of county tabulations, location maps, and hydrographs of selected representative observation wells, which are part of the statewide network of observation wells measured and recorded by the Texas Water Development Board.—Author's abstract

05731 **Howard, Keith Arthur.** Structure of the metamorphic rocks of the northern Ruby Mountains, Nevada [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1993B, 1967.

05955 **Hoyt, John H.** Barrier island formation: Geol. Soc. America Bull., v. 78, no. 9, p. 1125–1135, illus., 1967.

Empirical data fail to substantiate classical theories of barrier island formation from offshore bars. The hypothesis proposed here maintains that a barrier island is initiated by the building of a ridge immediately landward of the shoreline from wind- or water-deposited sediments. Slow submergence floods the area landward of the ridge forming a barrier and a lagoon. Once formed, the island may migrate or remain stationary depending on sediment supply, local hydrodynamic conditions, and land-sea stability. The width of the lagoon depends on the slope of the mainland surface, amount of submergence, sediment infilling, and erosion. Slow submergence or negligible sedimentation is necessary to maintain the lagoon. Emergence in excess of lagoonal depth terminates the barrier system.—*from* Author's abstract

05587 **Hubbard, Norman Jay.** Some trace elements in Hawaiian lavas [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1993B, 1967.

05664 **Hubbert, M. King.** Critique of the principle of uniformity, *in* Uniformity and simplicity—A symposium on the principle of the uniformity of nature: Geol. Soc. America Spec. Paper 89, p. 3–33, 1967.

In terms of the profundity of its effect in altering the intellectual outlook of the learned world, the scientific revolution referred to as Huttonian–Lyellian–Darwinian, was one of the two outstanding scientific developments since the fifteenth century. The author discusses the role and significance of one of its major philosophical tenets, the so-called Principle of Uniformity.—MST

05904 **Hudson, D. E.; Cloud, William K.** An analysis of seismoscope data from the Parkfield earthquake of June 27, 1966: Seismol. Soc. America Bull., v. 57, no. 6, p. 1143–1159, illus., tables, 1967.

An analysis of 16 seismoscope records from the Parkfield earthquake indicates the general usefulness of seismoscope data as a supplement to information produced by recording accelerographs. The pattern of attenuation of response spectrum values with distance from the fault was obtained, and certain anomalies in response spectrum values which may be related to local geologic structure were noted. The initial strong ground motions in the immediate vicinity of the fault were found to be predominantly transverse to the fault. A direct comparison of seismoscope results with response spectrum curves calculated from recorded ground acceleration–time curves indicates an overall seismoscope accuracy under typical field conditions of 10–15 percent.—Authors' abstract

05588 **Huebner, J. Stephen.** Stability relations of minerals in the system Mn–Si–C–O [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1993B–1994B, 1967.

05774 **Hume, David N.** Analysis of water for trace metals, [Chap.] 2 *in* Equilibrium concepts in natural water systems—Am. Chem. Soc., 151st Ann. Mtg., Pittsburgh, 1966, Div. Water, Air and Waste Chemistry Symposium: Washington, D.C., Am. Chem. Soc. (Adv. Chemistry Ser. 67), p. 30–44, tables, 1967.

Many methods exist which have the needed sensitivity for determining trace metals in natural waters. When the requirements of selectivity, accuracy, reliability, convenience, economy, and applicability to real systems are added, the number of methods is greatly reduced. Most promising among those remaining are flame and plasma emission, atomic absorption, colorimetry, direct and inverse polarography, and neutron activation analysis. Applying any of these methods to natural waters is subject to the usual hazards in trace analysis: measured quantities which may not be significantly large compared with random experimental error, and danger both of loss of material and adventitious contamination. Examples are given of the discrepancies which commonly arise in actual experimental work and the type of approach necessary to minimize them.—Author's abstract

05884 **Hunt, C. Warren.** Structure, seismic data and orogenic evolution of southern Canadian Rocky Mountains [discussion of paper by A. W. Bally and others, 1966]: Bull. Canadian Petroleum Geology, v. 15, no. 3, p. 379–382, 1967

Five minor objections to the original paper of the same title by A. W. Bally, P. L. Gordy, and G. A. Stewart (ibid., v. 14, no. 3, p. 337–381, 1966) are raised and discussed.—CAS

05591 **Hussain, Sultan.** A genetic study of the gray hydromorphic soils on the Hawaiian Islands [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1759B, 1967.

Huzzen, Carl S. *See* **Reiher, Barbara S.** 05886

05812 **Ida, Y.; Syono, Y.; Akimoto, S.** Effect of pressure on the lattice parameters of stishovite: Earth and Planetary Sci. Letters, v. 3, no. 3, p. 216–218, illus., 1967.

The effect of pressure to 130 kb was measured on the lattice parameters of the metastable stishovite, high-density polymorph of SiO_2, synthesized at high pressures and temperatures. The lattice parameter c was found to increase with pressure in the low pressure region. This reflects on the anomalous behavior of the compression curve of stishovite; the compressibility actually increases with pressure. Initial compressibility was determined to be 0.14 ± 0.05 mb^{-1}, being slightly small compared with the value determined from the shock wave data.—Authors' abstract

Inman, D. L. *See* Koontz, W. A. 05671

05480 **Intermountain Association of Geologists; Hale, Lyle A.** (editor). Anatomy of the western phosphate field—A guide to the geologic occurrence, exploration methods, mining engineering, recovery technology, 15th Ann. Field Conf. 1967: Salt Lake City, Utah, Intermountain Assoc. Geologists, 287 p., illus., tables, 1967.

The various papers describe sequentially the following: (1) depositional history and aerial distribution of the Phosphoria Formation, (2) the mechanics of earth forces responsible for the sinuous outcrop patterns and complex structural conditions, (3) petrographic and chemical character of phosphorite, (4) deciphering geologic complexities in terms of economic recoverability, (5) examples of typical mining practice and engineering procedures, (6) recovery methods as dictated by diverse ore types, (7) other related problems as market outlet, government regulations, air pollution, and water resources.—*from* Editor's foreword.

Irvine, T. N. *See* Smith, C. H. 05879

Irvine, T. N. *See* Smith, C. H. 05880

Irving, David C. *See* Guilday, John E. 05979

Jackson, M. L. *See* Roth, C. B. 05842

05875 **Jackson, Robert.** Mineral trails of New Jersey: River Vale, N. J., privately published, [32] p., illus., 1967.

Sketch maps, to be used in conjunction with a state highway map, are presented for 13 selected collecting localities in old mining areas of northern New Jersey; maps are not drawn to scale but mileage is indicated, and for detail, greater scale is given to immediate areas than to outer regions of the maps. Minerals that may be found are designated as to those collected by author, those collected by others, and those not of recent importance. Conditions to be found, tools needed, and cautions are suggested for each locality.—GDC

00063 **Jenik, A. J.; Lerbekmo, J. F.** Facies and geometry of Swan Hills Reef Member of Beaverhill Lake Formation (Upper Devonian), Goose River field, Alberta, Canada: Am. Assoc. Petroleum Geologists Bull., v. 52, no. 1, p. 21–56, illus., table, 1968.

The Swan Hills Member is divisible into a lower Dark Brown submember (stromatoporoid reef platform) and an upper Light Brown submember (stromatoporoid biohermal reef complex). Twenty-two rock types and eight environmental facies, distinguished within the reef complex, indicate an atoll-like reef development. Geomorphic features including outer slope, reef rim, reef crest, and central lagoon are evident. Biocalcarenite and biocalcirudite with well developed porosity are present in the reef-rim positions, whereas micritic rock types with low porosity are present in the central part of the reef complex. Large stromatoporoids, brachiopods, and crinoids are present in forereef positions; organic reef and backreef accumulations consist of *Stachyodes* and large stromatoporoids; and lagoonal parts are dominated by *Amphipora* with a few occurrences of ostracods, Foraminifera, and calcispheres.—*from* Authors' abstract

05768 **Jennings, Charles W.** (compiler). Geologic map of California, Olaf P. Jenkins edition—Salton Sea sheet: [San Francisco, Calif.] California Div. Mines and Geology, scale 1:250,000, separate explanatory sheet, 1967.

The explanatory sheet includes the index to geologic mapping used in compilation of the map; a stratigraphic nomenclature chart; photographs of crescentic dunes near the southwestern shore of the Salton Sea, and a view of Salton Sea area from Gemini 5, 100 miles high; and a map indicating topographic quadrangles within the Salton Sea sheet available from the U.S. Geological Survey.—MCM

00089 **Jensen, James A.** Withdrawing an old deposit from a national treasury—Recovering a new species of dinosaur: Our Public Lands, v. 18, no. 1, p. 14–17, illus., 1968.

A new species of sauropod dinosaur, belonging to the genus *Camarasaurus*, is being excavated from the Jurassic Morrison Formation along Dominguez Creek south of Grand Junction, Colo. Another outcrop of bone, 300 yd from the first revealed the anterior section of a sauropod somewhat larger than *Camarasaurus*, also new. The two pits compose the Dominguez–Jones Dinosaur Quarry. Since it is on public land, visitors were allowed during excavation.—ESL

05642 **Jillson, Willard Rouse.** Geology of the Flag Fork Fault in Franklin County, Kentucky: Frankfort, Ky., Roberts Printing Co., 51 p., illus., 1967.

The Flag Fork fault was traced for seven miles in northwestern Franklin County and found to terminate in anticlines at both ends. Rocks in the area are of Ordovician age, with the Woodburn Limestone the lowest unit exposed on the upthrown side, and the Maysville the highest. Fossils collected and listed are from Eden and Cynthiana beds and show a medial displacement on the fault of 65–75 feet. Nine exposures of the fault and three on the anticlines are described. This disturbance appears to be the barrier that terminates the twin Elkhorn faults.—ESL

05476 **Jobin, D. A.** Geology of the Caribou Range phosphate deposits, Bonneville County, Idaho, *in* Anatomy of the western phosphate field—Intermountain Assoc. Geologists, 15th Ann. Field Conf. 1967: Salt Lake City, Utah, Intermountain Assoc. Geologists, p. 61–71, illus., 1967.

In the Caribou Range of Idaho the Permian is composed dominantly of rocks of the Park City and Phosphoria Formations. The economically important Meade Peak Phosphatic Shale Member is relatively thin (54–68 feet). Since the Meade Peak parallels the strike of the range, changes in character and distribution of phosphate along the outcrop are minimal. Local depositional differences have resulted in differences in average thickness and grade of the phosphate deposits. Stratigraphy and P_2O_5 distribution are illustrated for the Meade Peak Member in correlated stratigraphic sections.—KAS

Johansen, Robert T. *See* Holmquest, Harold J., Jr. 00106

Johns, W. M. *See* Sahinen, U. M. 05619

Johnson, David G. *See* Turekian, Karl K. 05770

05657 **Johnson, G. Leonard; Heezen, Bruce C.** Morphology and evolution of the Norwegian–Greenland Sea: Deep-Sea Research, v. 14, no. 6, p. 755–771, illus., 1967.

Throughout the history of the Norwegian–Greenland Sea, the still active Mid-Oceanic Ridge has always been the dominant tectonic feature. It is cut by WNW-ESE fracture zones which originated early in the history of the basin and now bear evidence of the directions of early crustal movements.—Authors' abstract

Johnson, Gerald H. *See* Goodwin, Bruce K. 05676

05679 **Johnson, Gerald H.; Goodwin, Bruce K.** Elliptical depressions on undissected highland gravels in northern Chesterfield County, Virginia [abs.]: Virginia Jour. Sci., v. 18, no. 4, p. 186, 1967.

05976 **Johnson, Lane R.** Array measurements of P velocities in the upper mantle: Jour. Geophys. Research, v. 72, no. 24, p. 6309–6325, illus., tables, 1967.

A velocity structure for P waves in the upper mantle has been derived from $dT/d\Delta$ measurements in Arizona, using short-period P waves from earthquakes at $\Delta = O°$ to 30°. Corrections for the underlying crust have been applied, using crustal models derived from seismic refraction and gravity data. By including later arrivals on the seismograms, a fairly complete $dT/d\Delta$ curve has been constructed and inverted to obtain a velocity model for the upper 750 km of the mantle. The model includes a low-velocity zone with a high velocity gradient near its lower boundary. Two other regions with high velocity gradients are located near depths of 400 and 650 km and consist of 9–10 percent increases in velocity, spread out over 50 to 100 km. Traveltimes and amplitudes calculated for this model are consistent with observed data.—*from* Author's abstract

00087 **Johnson, Ralph Gordon; Richardson, Eugene S., Jr.** Ten-armed fossil cephalopod from the Pennsylvanian of Illinois: Science, v. 159, no. 3814, p. 526–528, illus., 1968.

Jeletzkya douglassae Johnson and Richardson is described as the oldest known representative of an extant squid group. The species is known from a single specimen from the Middle Pennsylvanian of Illinois. This very unusual fossil consists of the complete tentacular crown and a fragile shell. The arms bear hooks in double rows.—Authors' abstract

05766 **Johnson, Robert W., Jr.; Stearns, Richard G.** Bouguer gravity anomaly map of Tennessee: [Nashville, Tenn.] Tennessee Div. Geology, scale 1:500,000, 1967.

00040 **Joiner, T. J.; Warman, J. C.; Scarbrough, W. L.** An evaluation of some geophysical methods for water exploration in the Piedmont area: Ground Water, v. 6, no. 1, p. 19–25, illus., 1968.

In the Piedmont occurrence and movement of ground water are controlled by topography, recharge and discharge, rock type, fracture systems, and type and thickness of saprolite. This study covers an area of about 12 sq mi in the Heflin area, Cleburne County, Ala., where bedrock fractures are most effective avenues for ground-water movement, although domestic supplies can be produced from saprolite and alluvium. Thick saprolite absorbs water and releases it slowly to underlying fractures. Seismic methods were used with other data to locate favorable areas for drilling. On the seismic sections, faults and fracture systems correlate with depressions in bedrock surfaces associated with thick saprolite; 25 prospective areas for test drilling were defined. Resistivity data were used to confirm bedrock depth and to locate gravelly zones in buried channels.—*from* Authors' abstract

Jones, B. R. *See* Antoine, J. W. 05901

05943 **Jones, B. R.; Antoine, J. W.; Bryant, W. R.** A hypothesis concerning the origin and development of salt structures in the Gulf of Mexico sedimentary basin, *in* Symposium on the geological history of the Gulf of Mexico, Antillean-Caribbean region: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 211–216, illus., 1967.

An extensive fold belt on the continental shelf and slope of eastern Mexico has been established geophysically. Indirect evidence suggests that evaporites occur beneath the fold belt and are related to its origin. The hypothesis that the initial deformation of the salt was in the form of anticlines is supported. A possible sequence is: (1) folds developed under a relatively thin cover, (2) anticlinal ridges blocked sediment transport until they were buried, (3) secondary growth began from the crests of the folds when there was enough overburden to cause movement, and (4) the secondary growth may have triggered other salt structures not directly related to the anticlines.—*from* Authors' abstract

05703 **Judge, A. S.; Beck, A. E.** An anomalous heat flow layer at London, Ontario: Earth and Planetary Sci. Letters, v. 3, no. 2, p. 167–170, illus., table, 1967.

A hole at lat 43°00.6′ N., long 81°16.3′ W. is 1,948 feet deep. During drilling, water and bottom-hole temperatures, and gradiometer readings were monitored. Complete core was recovered. An anomalous cooler zone at 450 m is probably caused by water from snow melt entering some of the sedimentary rocks which

outcrop to the north. The water, driven southward toward the hole by the hydraulic head, absorbs heat as it flows along through the nearly flat sedimentary rocks.—HRC

00060 **Kanamori, Hiroo; Fujii, Naoyuki; Mizutani, Hitoshi.** Thermal diffusivity measurement of rock-forming minerals from 300° to 1,100°K: Jour. Geophys. Research, v. 73, no. 2, p. 595–605, illus., tables, 1968.

Measurement of thermal diffusivity, κ, of fused silica, quartz, olivine, periclase, jadeite, garnet, spinel, corundum and alkali feldspar was made at 1-atm pressure and over temperature range 300° to 1,100°K. All samples are of gem quality but of millimeter size; the Angström method was slightly modified to be applicable to small samples. For all minerals except feldspar $1/\kappa$ increases almost linearly with temperature up to 700°K. Tightly packed minerals, such as periclase, spinel, and corundum, have a diffusivity 3 to 10 times as large as that of other minerals. At temperatures higher than 700°K, $1/\kappa$ decreases with temperature for some minerals; this decrease can be interpreted as being due to radiative heat transfer within the crystals, if opacity of the minerals is in the range 6 to 20 cm^{-1}. High-temperature optical data are essential for a detailed discussion of radiation effect.—*from* Authors' abstract

00039 **Kazmann, Raphael G.** From water mining to water management: Ground Water, v. 6, no. 1, p. 26–28, 1968.

The significance of work associated with the protection of aquifers against salt-water encroachment, primarily in Southern California, goes far beyond the solution of this local problem. Engineers and planners are now able to turn to the record of extensive artificial ground-water recharge to modify the concepts based on theoretical studies. Thus, depleted aquifers can be evaluated as potential reservoirs for the storage of ground water in the same way, and on the same basis, that surface-water impoundments are evaluated. This work in artificial recharge increases the number of alternates that are available to the water planner, and may be the most significant outputs of the engineering, construction, and operation of the barrier projects.—*from* Author's abstract

05864 **Keech, C. F.; Dreeszen, V. H.; Emery, P. A.** Availability of ground water in York County, Nebraska: U.S. Geol. Survey Water-Supply Paper 1839-F, p. F1–F17, illus., table, 1967.

York County is on an upland plain underlain to depths of 100–450 feet by unconsolidated Quaternary deposits which mantle the eroded surface of marine strata of Cretaceous age. The upper Quaternary is largely wind-deposited clayey silt; the lower part consists of saturated alluvial sand and gravel which constitute a highly productive aquifer throughout much of the county. As the quantity of ground water pumped per year greatly exceeds average annual recharge, most of the water used for irrigation is from storage; it is of calcium bicarbonate type, hard, but chemically suitable for irrigation on most soils. Except where the bedrock is fractured or creviced, its water is generally too saline to be potable. A generalized section of the geologic formations includes their water-bearing properties.—GDC

Kehm, Alexis. *See* Lidz, Barbara. 00115

Keil, Klaus. *See* Bunch, T. E. 05953

05962 **Keller, George V.** Induced polarization well logging, *in* SPWLA Logging Symposium, 8th Ann., Denver, 1967, Trans.: Houston, Tex., Soc. Prof. Well Log Analysts, p. W1–W16, illus., 1967.

As used in geophysical exploration, induced polarization means the anomalous storage of electrical charge in rocks, as a result of complicated electrochemical effects which take place during current flow. These effects may be associated with the oxidation or reduction of metallic minerals, as current passes through their surfaces, or they may be associated with variations in ion mobility within pore structure of a rock. Continuous measurement of induced polarization effects in wells has been used as a well logging method. Current in the form of D.-C. pulses is supplied

to a pair of inhole electrodes, while the transient decay voltages following these pulses are detected with a second pair of electrodes and recorded. Induced polarization logs are useful in evaluating mineral prospect boreholes, but such measurements may also have some application in evaluating permeability in sedimentary rocks.—Author's abstract

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00066 **Kelly, T. E.** Geology and ground water resources of Grand Forks County—Pt. 2, Ground water basic data: North Dakota Geol. Survey Bull. 53, pt. 2 (North Dakota Water Comm. County Ground Water Study 13), 117 p., illus., tables, 1968.

The purposes of this investigation were to determine the location and extent of ground-water reservoirs; to evaluate the occurrence and movement of ground water, including the sources of recharge and discharge; and to determine the chemical quality of the water. Information presented was collected mainly between 1964 and 1967 and consists of the following: (1) data on about 1,000 wells, springs, and test holes; (2) water-level measurements in 69 observation wells; (3) logs of about 160 test holes and selected wells; and 40 chemical analyses of 96 water samples.—MST

05763 **Kelly, T. E.; Block, D. A.** Geology and ground water resources, Barnes County, North Dakota—Pt. 1, Geology: North Dakota Geol. Survey Bull. 43, pt. 1 (North Dakota Water Comm. County Ground Water Study 4), 51 p., illus., geol. maps, 1967.

The landforms and drainage systems of Barnes County were formed during the late part of the Wisconsin glaciation. At least seven distinct drifts are present, and are differentiated mainly on the basis of landform rather than lithology. Most of the county consists of gently undulating plains of ground moraine separated by relatively narrow, elongate end moraines, and lacks an integrated drainage system, although the Sheyenne River flows through from north to south. Rocks of Cambrian and Ordovician age are separated from Cretaceous strata by an angular unconformity. Cretaceous rocks consist of the Dakota and Colorado Groups and the lowest formation of the Montana Group.—MST

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05589 **Khan, Mohammad Asadullah.** Development of a new theory for determination of geopotential from the orbital motion of artificial satellites [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1994B–1995B, 1967.

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05468 **King, Duncan L., Sr.** San Francisco Chemical Co.—Crawford Mountain-Leefe area, Utah and Wyoming, *in* Anatomy of the western phosphate field—Intermountain Assoc. Geologists, 15th Ann. Field Conf. 1967: Salt Lake City, Utah, Intermountain Assoc. Geologists, p. 203–209, illus., 1967.

Phosphate rock is mined from the Meade Peak Member of the Phosphoria Formation at the Leefe area. A brief description of the stratigraphy, structural features, history of the mine, and mining and treatment is given. Experimental mining operations in the Crawford Mountains are discussed.—KAS

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Klapper, Gilbert. *See* Amsden, Thomas W. 00044

05967 **Klassen, R. W.** Surficial geology of the Waterhen–Grand Rapids area, Manitoba: Canada Geol. Survey, Paper 66–36, 6 p., geol. map, 1967.

Much of this area, which is within the Manitoba Plains physiographic province, is covered by ground moraine composed of light grey, silty, stony till derived largely from carbonate bedrock. This is commonly capped by one to three feet of clayey brown till, stony brown clay and/or lag gravels. Although the upper few feet of the surface deposits commonly show the effects of lacustrine erosion or deposition, glacio–lacustrine deposits are mainly restricted to narrow belts of coarse beach gravels. Minor intersecting lineaments were apparently formed by the action of floating lake ice and are not due to permafrost, wave action, or running water, nor are they reflections of bedrock fracture patterns. Two distinctive tills indicate there were two intervals of glaciation.—*from* Author's abstract

Kleinhampl, Frank J. *See* Albers, John P. 05723

Kleppa, O. J. *See* Holm, J. L. 05921

05881 **Klovan, J. E.; Billings, G. K.** Classification of geological samples by discriminant–function analysis: Bull. Canadian Petroleum Geology, v. 15, no. 3, p. 313–330, illus., tables, 1967.

Discriminant–function analysis is a statistical method useful in geological problems involving classification. The method is described in terms of a simple geometrical model using, as an example, the frequency of occurrence of percent porosity and horizontal permeability of suites of limestone and dolomite. The method is then used to show that the Precambrian amphibolites of an area in the Llano region of Texas are the metamorphic equivalents of tholeiites.—WAC

05637 **Knight, Richard R.; Mudge, M. R.** Characteristics of some natural licks in the Sun River area, Montana: Jour. Wildlife Management, v. 31, no. 2, p. 293–299, illus., table, 1967.

In the Sun River area of Montana, ruminants have established licks in only three of 25 outcropping bedrock units, which locally are mantled by glacial till. The three units [Upper Jurassic Rierdon Formation, Upper Cretaceous Ferdig Shale and Kevin Shale Members of Marias River Shale] are all mudstones deposited in shallow–water marine environments. Rapid chemical and spectrographic analyses of rock and spring water in the licks were compared with analyses of rocks and waters unrelated to licks. Sodium bicarbonate and sodium sulfate are the only compounds that occur in much greater quantities in licks than elsewhere; boron and lithium also occur in slightly larger quantities. Calcium, magnesium, and strontium, are generally less abundant in licks. Chlorine occurs in small but normal quantities in both lick and nonlick waters.—*from* Authors' abstract

05792 **Knopoff, L.** Thermal convection in the earth's mantle, Chap. 8 *in* The Earth's mantle (T. F. Gaskell, editor): London and New York, Academic Press, p. 171–196, illus., 1967.

The hypothesis that continental drift has occurred during Earth history is coupled with the notion that there is significant thermal convection in the mantle. Various models for convection in fluid envelopes are tested, mainly on geophysical grounds. If convection is postulated in a fluid mantle thermally driven from below it must take place in relatively narrow bands within the upper mantle. Any convection that may occur in the lower mantle is effectively decoupled. Recent discoveries of first–order jump discontinuities in the upper mantle must reduce the thicknesses of layers in which it can convect. Experiments have shown that internal heat may provide a more potent method of driving material in convective flow than heating from beneath the material. Lateral thermal instabilities can provide a significant alternate source of convective motion in the Earth's mantle.—JPF

Knowles, C. R. *See* Boettcher, A. L. 05695

05732 **Knowles, David Martin.** The structural development of Labrador trough formations in the Grenville Province, Wabush Lake area, Labrador [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1995B, 1967.

Koczy, F. F. *See* Szabo, B. J. 05741

Koenig, Karl J. *See* Morelock, Jack. 05749

Kohman, Truman P. *See* Lefelhocz, John F. 05922

05910 **Kohout, F. A.** Ground-water flow and the geothermal regime of the Floridian Plateau, *in* Symposium on the geological history of the Gulf of Mexico, Antillean-Caribbean region: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 339–354, illus., table, 1967.

The geothermal gradient for the Floridian Plateau is negative to a depth of about 3,000 feet below sea level. At 3,000 feet it is about 70°F near the edge of the deep sea water bodies and more than 108° toward the central axis. The temperature distributions suggest that cold, dense sea water flows inland in the deep part of the aquifer, where it becomes progressively heated by upward geothermal heat flow. This produces an upward convective circulation which brings the sea water into contact with fresh water and further reduces the density. The water then flows seaward and discharges by upward leakage through confining beds into shallow aquifers or through submarine springs.—*from* Author's abstract

Kolvoord, Roger W. *See* Traverse, Alfred. 00119

05671 **Koontz, W. A.; Inman, D. L.** A multi-purpose data acquisition system for instrumentation of the nearshore environment: U.S. Army Corps Engineers Coastal Eng. Center Tech. Memo. 21, 38 p., illus., 1967.

Most energy from ocean waves and tides is ultimately transmitted to the coastal periphery or nearshore zone. Its dissipation creates a complex environment, with intense interactions between waves, currents, and sediments. A digital data acquisition system, used in the laboratory and field, provides instantaneous-synoptic measurements of the nearshore environment. Using modern computer techniques, the system can efficiently acquire and analyze a tremendous volume of data. Special sensors of the system include: a digital wave gage with self-contained logic circuitry; a vibrating-wire transducer to measure pressures on the bottom; a Savonius current meter; and a photography technique for estimating the density of suspended sediments.—*from* Authors' abstract

00059 **Kottlowski, Frank E.** Sedimentational influence of Pedernal uplift [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 52, no. 1, p. 197, 1968; Shale Shaker, v. 18, no. 5, p. 99, 1968.

05781 **Kramer, James R.** Equilibrium models and composition of the Great Lakes, [Chap.] 11 *in* Equilibrium concepts in natural water systems—Am. Chem. Soc., 151st Ann. Mtg., Pittsburgh, 1966, Div. Water, Air and Waste Chemistry Symposium: Washington, D.C., Am. Chem. Soc. (Adv. Chemistry Ser. 67), p. 243–254, illus., tables, 1967.

To a good first approximation, the Great Lakes fit a model involving the equilibrium of calcite, dolomite, apatite, kaolinite, gibbsite, Na- and K-feldspars at 5°C, 1 atm total pressure with air of $P_{carbon\ dioxide} = 3.5 \times 10^{-4}$ atm and water. Dynamic models, considering carbon dioxide pressure and temperature as variables (but gross concentrations fixed), show that cold waters contain excess carbon dioxide and are unsaturated with respect to calcite, dolomite, and apatite, whereas warm waters are nearly at equilibrium with the atmosphere but somewhat supersaturated with respect to calcite, dolomite, and apatite.—Author's abstract

05883 **Kramers, J. W.; Lerbekmo, J. F.** Petrology and mineralogy of Watt Mountain Formation, Mitsue-Nipisi area, Alberta: Bull. Canadian Petroleum Geology, v. 15, no. 3, p. 346–378, illus., tables, 1967.

The Middle Devonian Watt Mountain Formation is described from cores of 12 wells in an area between Edmonton and Peace River. The formation consists largely of interbedded sandstone and green and brown mudstone of shallow-water marine to nonmarine origin. A dolomite unit lies near the base, and a feldspathic unit (Gilwood Sandstone Member) lies near the middle. Sandstone petrography was studied in thin sections, and mudstone mineralogy was studied by X-ray diffraction and differential thermal analysis. The source area was probably the igneous metamorphic terrain of the Peace River high.—WAC

05822 **Kremp, Gerhard O. W.** Tetrad markings of pteridophytic spores and their evolutionary significance: Rev. Palaeobotany and Palynology, v. 3, nos. 1–4, p. 311–323, illus., tables, 1967.

Representatives of 277 genera of living ferns were investigated. In 29 percent of the cases, spores were exclusively trilete, 49 percent were exclusively monolete, and 22 percent were mixed or had transitional apertures. All were sometimes noted in the same species. Zonate spores make up four percent of the total. Trilete spores appear in the Silurian, and monoletes since Middle Devonian. The progression from trilete to zonate and/or to monolete can be traced through all orders of pteridophytes. The spore mother cell may have provided more food supply, hence giving an evolutionary advantage. Coniferous monosaccate spores may have progressed from zonate spores. Microgamete generations in pteridosperms may have derived from progression of monolete spores to presulcate and/or sulcate pollen.—*from* Author's summary

00152 **Krizek, Raymond J.; Anand, Vera B.** Flow around a vertical sheetpile embedded in an inclined stratified medium: Water Resources Research, v. 4, no. 1, p. 113–123, illus., 1968.

Steady-state flow around a vertical sheetpile embedded in an inclined stratified synthetic 'sandstone' as a porous medium underlain by an impervious boundary is studied experimentally. A coordinate transformation based upon considering the layered system homogeneous and anisotropic was used, and a graphical flow net solution obtained for the streamlines, potential distribution, and flow quantity. Complex variable theory and conformal mapping techniques are used to get an approximation for flow quantity and exit gradient variation. These results, especially flow quantity, varied somewhat from theoretically predicted results, and suggest that perhaps effective permeability in this case cannot be determined by considering the system as homogeneous and anisotropic.—*from* Authors' abstract

05961 **Ku, Teh-Lung; Broecker, Wallace S.** Uranium, thorium, and protactinium in a manganese nodule: Earth and Planetary Sci. Letters, v. 2, no. 4, p. 317–321, illus., tables, 1967.

Isotopic compositions of uranium, thorium and protactinium have been determined in a manganese nodule dredged from the North Pacific Ocean. Both the Th-230 and Pa-231 activities are found to decay exponentially with depth in the nodule. The corresponding accretion rate of the nodule, averaged over the past several hundred thousands of years, is about $4mm/10^6y$. The depth distribution of the unsupported U-234/U-238 ratio of the oceanic uranium has undergone a rather minor change for the last few hundred thousand years. The fluctuation has been no more than ±2 percent of the present value of 1.15.—Authors' abstract

Kubota, Susumu. *See* Berg, Eduard. 05894

05790 **Kuno, Hisashi.** Volcanological and petrological evidences regarding the nature of the upper mantle, Chap. 5 *in* The Earth's mantle (T. F. Gaskell, editor): London and New York, Academic Press, p. 89–109, illus., tables, 1967.

The existence of a gabbro-peridotite boundary at the M-discontinuity is supported by the common occurrence of this rock association in the form of inclusions in basaltic rocks throughout the world. Systematic compositional variation exists among primary basalts, which cannot be ascribed to crystal fractionation or to contamination during ascent of magma. Zones of tholeiite, high alumina basalt, and alkali olivine basalt are arranged in a regular pattern in the circum-Pacific

volcanic belt, which coincides with progressive increase of depth of earthquake foci in the mantle from oceanic to continental sides. This distribution pattern suggests that the different basalt magmas are generated at successively greater depths, under varying physical conditions associated with the transition from oceanic to continental mantle.—JPF

00032 **Kuo, John T.; Barla, G.; Boshkov, Stefan H.** Static loading on the surface of layered media [abs.]: Mining Eng., v. 20, no. 1, p. 93, 1968.

Kuroda, P. K. *See* Ganapathy, R. 05729

00061 **Kushiro, Ikuo.** Compositions of magmas formed by partial zone melting of the Earth's upper mantle: Jour. Geophys. Research, v. 73, no. 2, p. 619–634, illus., tables, 1968.

The composition of magmas produced by partial melting of mantle peridotites depends on the position of the isobaric invariant point where olivine and orthopyroxene are involved in systems including components of minerals of the mantle peridotites. Investigation of the position of such invariant points in several systems suggests that the composition of magmas produced by the partial melting of the mantle peridotites would become more silica-deficient with increasing pressure, and that pyroxene-garnet magmas would be formed by partial melting of mantle peridotites at pressures less than 30 kb. Magmas formed in the upper mantle would ascend by a "partial zone melting" mechanism in levels where temperature is close to the beginning of melting of mantle peridotites. Compressional change in ascending magmas depends on the isobaric invariant point involving olivine and orthopyroxene, and can be estimated on the basis of the present experiments.—DBV

Laird, Wilson M. *See* Robertson, Forbes. 05807

00162 **LaMarche, Valmore C., Jr.** Rates of slope degradation as determined from botanical evidence, White Mountains, California: U.S. Geol. Survey Prof. Paper 352-I, p. 341–377, illus., tables, 1968.

Some trees in a subalpine bristle-cone pine forest, growing on a gentle slope underlain by the Reed Dolomite, are dated up to over 4,000 years ago, most averaging 1,000 years. Roots of growing pines are concentrated in the upper foot of soil and are uncovered and progressively exposed with time. Slope degradation can be calculated from the amount of exposure when the tree's death date can be determined. Rates vary from less than 0.5 ft per 1,000 yr on gentle slopes to 4 ft per 1,000 yr on steep gradients. Present-day stream transportation rates are shown to be sufficient to account for the calculated rates.—*from* Authors' abstract

Lange, A. L. *See* Westphal, W. H. 05891

05697 **Lange, Arthur L.; MacKenzie, Michael V.** Computer processing of magnetic model data [abs.]: Mining Eng., v. 19, no. 12, p. 30, 1967.

Langenheim, R. L., Jr. *See* Marks, J. W. 05669

Langseth, Marcus G. *See* LePichon, Xavier. 05951

Langway, C. C., Jr. *See* McCorkell, R. 05960

05613 **LaRocque, Aurèle.** Pleistocene Mollusca of Ohio: Ohio Div. Geol. Survey Bull. 62, pt. 2, p. 113–356, illus., 1967.

The author describes, figures, and then shows the distribution in North America and in Ohio of Pleistocene molluscs of the Orders Prionodesmacea and Teleodesmacea (Family Sphaeriidae) Dall in this second part of a four part work. The order Prionodesmacea is represented in Ohio by two families, the Margaritanidae and Unionidae, which are grouped together as the Naiades or freshwater mussels. Shells of this group are seldom found in lists of Pleistocene Mollusca in Ohio or elsewhere, because the size of these clams makes it unlikely

that they would be included in small samples usually taken, and they break down easily when attempts are made to remove them. Two genera of the Sphaeriidae occur in Ohio—*Sphaerium* Scopoli 1777 and *Psidium* C. Pfeiffer 1821.—MST

00062 **Latham, Jack W.** Petroleum geology of Arbuckle Group (Ordovician), Healdton field, Carter County, Oklahoma: Am. Assoc. Petroleum Geologists Bull., v. 52, no. 1, p. 3–20, illus., table, 1968.

In the Healdton field oil is produced mostly from the Pennsylvanian Hoxbar Group and the Early Ordovician Arbuckle Group. The Arbuckle is predominantly carbonate, about 5,000 feet thick, and produces primarily from three dolomite zones in the upper 1,600 feet. The lowest of the three productive units, the Brown zone, is the field's main objective and consists of very permeable dolomite about 600 feet thick. The structural closure exceeds 1,500 feet and the oil column is as much as 700 feet thick. The anticline that trapped the hydrocarbons resulted from the Wichita Mountains–Criner Hills orogenic movement which began in Early Pennsylvanian time and was reactivated in Late Pennsylvanian time. The slightly folded Hoxbar strata lie upon an eroded pre–Pennsylvanian surface; the underlying Arbuckle is faulted and more tightly folded.—EAM

Lawson, D. C. *See* Sahinen, U. M. 05619

Lee, Hulbert A. *See* Hobson, George D. 05744

05922 **Lefelhocz, John F.; Friedel, Robert A.; Kohman, Truman P.** Mössbauer spectroscopy of iron in coal: Geochim. et Cosmochim. Acta, v. 31, no. 12, p. 2261–2273, illus., tables, 1967.

Fe-57 Mössbauer spectra of coal samples were measured in order to obtain information about the so-called "organically-bound" iron in coal. Nine vitrain or whole-coal samples from lignite (72 percent C) to anthracite (93 percent C) have been investigated. Five coals which were known from chemical analysis to contain sulfide iron yielded the symmetric two-line spectrum of pyrite, with a room temperature isomer shift relative to sodium nitroprusside of $\delta = +0.54$ mm per sec and a quadrupole splitting of $\Delta = 0.58$ mm per sec. Five coals which were believed to contain "organic" iron yielded a symmetric two-line spectrum with $\delta = +1.38$ mm per sec and $\Delta = 2.62$ mm per sec. These parameters, including the equality of line intensities, differ from those of any known iron Mössbauer spectrum; they indicate high-spin iron (II) in sixfold coordination.—*from* Authors' abstract

05788 **Lehmann, I.** Low-velocity layers, Chap. 3 *in* The Earth's mantle (T. F. Gaskell, editor): London and New York, Academic Press, p. 41–61, illus., 1967.

Nuclear and chemical explosions have contributed importantly to seismological interpretation of the Earth's upper mantle. Regional differences in mantle structure are common, and sometimes quite abrupt within continents. It is known from surface wave work that extended low-velocity channels exist for transverse waves in the uppermost mantle. Observations of body waves confirm these findings, but do not permit distinction between the interdependent effects of layer thickness and velocity on the delay of S-waves. The limits of resolution of body-wave methods have not yet been reached. Indications suggest that low-velocity layers are situated deeper beneath shield areas than under new mountains.—JPF

05887 **Leopold, L. B.** Standards for water quality [with French abs.], *in* Petroleum industry—General problems—World Petroleum Cong., 7th, Mexico, 1967, Proc., V. 9: London, Elsevier Publishing Co., p. 271–275, 1967.

The quality which is necessary depends on the use to which the water will be put. Because uses vary, so also must quality standards. Maintaining any level of quality presents a problem of cost and depends on variations in natural water characteristics, in time and space, and variations in volume and types of wastes. For quality standards appropriate to a given water body, hydrologic network data can provide duration curves of flow, concentrations of dissolved oxygen, dissolved solids, including nutrients (nitrates and phosphates), turbidity, temperature, and other significant chemical, physical, and biological parameters. Standards can then be

expressed as occurrences in percentage of time or with respect to flow.—Author's abstract

05951 **LePichon, Xavier; Langseth, Marcus G.** Comments on paper by Francis Birch, "Low values of oceanic heat flow" [1967]: Jour. Geophys. Research, v. 72, no. 24, p. 6377–6378, illus., table, 1967.

A valid comparison of Birch's (ibid., no. 8, p. 2261–2262, 1967) theoretical distribution with measured distribution of heat flow values requires a distinction between ridges and basins. Data for ridges and basins are summarized separately here, using statistics of Lee and Uyeda (1965), the basis of Birch's comparison. Values for Birch's theoretical model were computed by a development in series of e^{-rz}. Distribution of values for that model does not fit ocean basins but agrees better with ridges; even over ridges, the scatter of measurements is larger than predicted by Birch. The model of topography suggested by Birch can explain the frequent occurrence of low heat flow measurements in ridges, but predicted distribution of values is too different from those observed over basins and ridges to support the existence of large areas of topography of that type.—DBV

Lerbekmo, J. F. *See* Jenik, A. J. 00063

Lerbekmo, J. F. *See* Kramers, J. W. 05883

05938 **Leutze, W. P.** Stratigraphic utility of *Sphaeroidinella* Cushman in Louisiana: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 152–158, illus., 1967.

The modern *Sphaeroidinella decibens* is a product of two lines of evolution; two genera, six species, and several subspecies are discussed. Irrespective of nomenclature *Sphaeroidinella* s.l. is useful in Miocene to Recent stratigraphic correlation. Different morphological trends are discussed. The safest single index to stratigraphic age is the degree of chamber separation. All the gradations between "species" can be observed. The forms of *Sphaeroidinella* in Louisiana are not contemporaneous with similar forms in the Caribbean region. There is some evidence that *S. decibens* is a deep water variant of *Globigerinoides sacculifer*. Benthonic associates of fossil specimens suggest that *Sphaeroidinella* did not require great water depths in the past.—*from* Author's abstract

Lewis, Charles F. *See* Moore, Carleton B. 05974

Lewis, Roland W. *See* Edwards, Donald M. 00127

00115 **Lidz, Barbara; Kehm, Alexis; Miller, Hendrick.** Depth habitats of pelagic foraminifera during the Pleistocene: Nature, v. 217, no. 5125, p. 245–247, illus., tables, 1968.

Work initiated by Emiliani (1954) has been extended through different glacial and interglacial intervals, using a deep-sea core from the central Caribbean which represents a continuous and undisturbed sediment section extending back 275,000 years. Oxygen isotope ratios and corresponding paleotemperatures are tabulated for selected levels of the core. Other tables give isotopic temperatures and calculated depth habitats obtained from the recent sample 10 cm below the top and from the average of all warm samples, with mean isotopic temperatures of the cold stages. These results are compared with temperatures and depth habitats observed by Jones (1967) in the equatorial Atlantic.—DBV

05973 **Lieberman, K. W.; Ehmann, W. D.** Determination of bromine in stony meteorites by neutron activation: Jour. Geophys. Research, v. 72, no. 24, p. 6279–6287, tables, 1967.

Eighteen chondrites and seven achondrites have been analyzed for bromine by thermal neutron activation. Fourteen of the specimens were analyzed in replicate. Bromine is found to be fractionated among the three types of chondrites: carbonaceous 3.04, enstatite 1.64, and ordinary 0.34 ppm Br. This trend is similar to the depletion pattern found by other investigators for iodine. Bromine is found to have a higher abundance in the type I carbonaceous chondrites (atomic abundance

of 18.6 relative to $Si = 10^6$ atoms) than has been predicted by calculations based on theories of nucleosynthesis. Bromine is not depleted in the howardite–eucrite grouping of achondrites with respect to the ordinary chondrites, in spite of the depletion of alkali elements with which bromine is often associated in natural materials.—Authors' abstract

05935 **Lindemann, William L.; McBride, Earle F.** Source of detritus in the Gueydan (Catahoula) Formation, southern Texas Gulf Coast [abs.]: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 149, 1967.

05449 **Lipman, Peter W.** Reply to Ewart's discussion [of 1966 paper, "Water pressures during differentiation and crystallization of some ash–flow magmas from southern Nevada", 1967]: Am. Jour. Sci., v. 265, no. 10, p. 905–906, 1967.

Lipman is in general agreement with Ewart's comments (ibid., p. 898–904), but makes further comments on leaching of alkalis during hydration of pumices, and points out that the same results could be achieved by conventional calculation of groundmass composition of rock, starting from bulk–rock chemical analysis and modal–phenocryst analysis, as by the additional method for estimating water pressures.—VSN

05722 **Livingston, Clifton W.; Lord, Kenneth.** The application of principles of rock mechanics to blasting and support of the Norad excavation [abs.]: Mining Eng., v. 19, no. 12, p. 34, 1967.

Livingstone, C. E. *See* Caner, B. 05950

Loeblich, Alfred R., Jr. *See* Drugg, Warren S. 05956

00049 **Lorber, Harvey R.** Local statistical variations in the composition of marine manganese nodules [abs.]: Mining Eng., v. 20, no. 1, p. 91, 1968.

Lord, C. W. *See* Shannon, J. P., Jr. 05757

Lord, Kenneth. *See* Livingston, Clifton W. 05722

05623 **Love, J. D.** Vanadium and associated elements in the Phosphoria Formation in the Afton area, western Wyoming, *in* Anatomy of the western phosphate field—Intermountain Assoc. Geologists, 15th Ann. Field Conf. 1967: Salt Lake City, Utah, Intermountain Assoc. Geologists, p. 115–118, illus., 1967.

Only one of several vanadiferous zones found has sufficient thickness, grade, and continuity to be of possible economic interest. The zone is 3–5 feet wide and is composed of 6 beds of black shale and dark gray mudstone belonging to the Meade Peak Member. Chemical analyses show that a central shale bed, 0.5–1 ft thick is the richest, averaging 1.6 percent V_2O_5 beds above and below are sucessively lower grade. The full zone averages 0.7 percent V_2O_5. Small amounts of Si, Mo, Zn, Ni, Co, Ti, and Cd are present in the vanadiferous zone with the greatest concentrations corresponding to that of vanadium; chronium is concentrated in the upper and lower beds of the zone. The vanadium and associated elements were deposited contemporaneously with rocks of the Meade Peak as precipitates from solution.—KAS

Lovering, J. F. *See* Morgan, J. W. 05811

00135 **Lovering, Thomas S.** Future metal supplies, the problem of capability [summ.]: Oklahoma Geology Notes, v. 28, no. 1, p. 27–28, 1968.

Current economic doctrine is based on debatable assumptions. There is no known geologic reason why the doctrine of geometric increase of tonnage with arithmetic decrease in grade should be true for most types of geologic processes. It does not hold for most veins, replacement deposits in carbonate rocks, nor magmatic segregations. Iron, aluminum, and copper porphyry deposits may follow this ratio. For many other metals essential to industry, acute supply problems loom ahead.—ESL

05719 **Lowell, J. David.** Discovery and exploration of the Kalamazoo orebody, San Manuel district, Arizona [abs.]: Mining Eng., v. 19, no. 12, p. 41, 1967.

05794 **Lubimova, E. A.** Theory of thermal state of the earth's mantle, Chap. 10 *in* The Earth's mantle (T. F. Gaskell, editor): London and New York, Academic Press, p. 231–323, illus., tables, 1967.

Temperature distribution in the Earth's interior is related to geothermal gradient, sources of inner heat, processes of heat transfer, and thermal evolution. Radioactive decay of U, Th, and K, and gravitational energy liberated during core formation are major sources of inner heat energy. Thermal effects of tidal friction could result in melting at the low velocity zone. For purposes of heat transfer the mantle should be regarded as dielectric or semi-conducting, whereas the core has metallic conductivity. The phonon (lattice) component of the mantle is inversely proportional to temperature; it predominates in upper layers, causing slow heat loss and accumulation of radioactive heat in the interior. Mathematical analyses suggest surface heat flow is determined by an escape zone involving the upper mantle; flow decreases with time where the crust is stabilized. Simultaneous heating of the lower mantle results in thermoelastic stresses.—JPF

05771 **Ludlam, Stuart D.** Sedimentation in Cayuga Lake, New York: Limnology and Oceanography, v. 12, no. 4, p. 618–632, illus., tables, 1967.

The sediments in the southern half of Cayuga Lake are generally banded. The couplets are ca. 2 cm thick at a depth of 1.5 m in the sediment and contain finer laminae approximately 1 mm thick. Major bands can be correlated over a distance of 19 km and apparently correspond to recorded periods of unusually rapid runoff or high lake levels. It is concluded that the deposition of the couplets is controlled by annual variation in the supply of allochthonous organic detritus and clastic sediment. A total of 2×10^{11} g dry weight of clastic sediment enters the lake annually through its tributaries. Turbidity currents apparently are responsible for the distribution of a large fraction of this material in the lake.—Author's abstract

05635 **Lundberg, John G.** Pleistocene fishes of the Good Creek Formation, Texas: Copeia 1967, no. 2, p. 453–455, illus., 1967.

The Good Creek Formation consists chiefly of alluvial deposits of the Pleistocene Good Creek, in Foard County, Texas. W. W. Dalquest (1962) assigned the formation to the Sangamon Interglacial on the basis of its mammalian fauna and vertebrate warm-climate indicators, but D. W. Taylor (1965) regarded it as early Wisconsin because of the many northern forms of mollusks. The fossil fishes from Dalquest's collection, a part of the Easley Ranch local fauna, are here identified as *Lepisosteus* spp., *Campostoma anomalum*, *Ictalurus natalis*, and *Lepomis cyanellus*; other fish material in the collection was not available for the present study. All the fossil fish species (as presently identified) occur in the area today.—VMJ

05691 **Lyall, Anil K.; Gees, R. A.** Near-shore sediment distribution around Cape Sable Island, Nova Scotia, Canada: Maritime Sediments, v. 3, nos. 2–3, p. 65–66, illus., 1967.

Cape Sable Island, at the southern tip of Nova Scotia, is mostly covered by glacial debris. Bedrock is composed of the Meguma Group of slates and quartzite on the east half, and Devonian granite on the west. South of the island, and separated from it by a lagoon, is the Cape sand bar, a tombolo series of till masses. Based on 250 bottom samples, the offshore area can be divided into two parts: Barrington Bay and Passage are characterized by depositional facies, and the southern and southeastern part by nondepositional or residual type sediments. Sand is the main deposit. Mud, containing considerable organic material, is deposited in the upper parts of Barrington Passage and Bay. Gravels are mostly granite and residual from glacial debris.—ESL

Lyall, Anil K. *See* Swift, Donald J. P. 05692

05963 **Macintyre, Robert Mitchell.** Studies in potassium-argon dating [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 4, p. 1587B–1588B, 1967.

MacKenzie, Fred T. *See* Garrels, Robert M. 05780

MacKenzie, Michael V. *See* Lange, Arthur L. 05697

MacKenzie, W. B. *See* Wallace, S. R. 05716

Madison, R. J. *See* Richardson, Donald. 00075

Major, M. W. *See* Wideman, C. J. 05893

00084 **Manghnani, Murli H.; Schreiber, Edward; Soga, Naohiro.** Use of ultrasonic interferometry technique for studying elastic properties of rocks: Jour. Geophys. Research, v. 73, no. 2, p. 824–826, illus., table, 1968.

This communication reports data on the elastic properties of a specimen of obsidian, determined by the pulse superposition method. This is the first example of the successful application of this method to a natural rock material. The results confirm that the simple equations of state currently used in geophysical theories do not apply to obsidian.—DBV

05463 **Mann, John A.** High school geology for adults: Jour. Geol. Education, v. 15, no. 5, p. 181–184, 1967.

A geology course for adults, offered in the Whittier (Calif.) Union High School District, meets weekly and is divided by semester into physical geology and historical and economic geology. Its scheduled field trips are well attended. Motivation of adults is varied, and the spread in educational background necessitates some basic instruction in other sciences. A surprising number of students go on to enroll in earth science courses at college level. Teaching geology to adults without previous science experience can be undertaken successfully, and provides a valuable addition to adult high school curricula.—*from* Author's abstract

Manuel, O. K. *See* Bennett, J. H. 05700

05918 **Manuel, O. K.** Noble gases in the Fayetteville meteorite: Geochim. et Cosmochim. Acta, v. 31, no. 12, p. 2413–2431, illus., tables, 1967.

Noble gases were extracted from the dark portions of Fayetteville by heating the sample to successively higher temperatures up to 1600°C. It is shown that the isotopic composition of Ne observed could be produced from a mixture of primordial Ne, cosmogenic Ne and highly mass-fractionated primordial Ne. The isotopic composition of He, Ne, and Ar indicate a primordial component for which $He\text{-}3/He\text{-}4 \leq 0.00031$, $Ar\text{-}38/Ar\text{-}36 \leq 0.177$, $Ne\text{-}20/Ne\text{-}22 \geq 12.6$, and $Ne\text{-}21/Ne\text{-}22 \geq 0.033$. Xenon spectra show an excess of the heavy Xe isotopes with a mass yield curve intermediate between that observed in Pasamonte and that in the Earth's atmosphere. It is shown that this atmosphere-like Xe component is not due to contamination but is definitely a component of meteoritic Xe.—*from Author's abstract*

05669 **Marks, J. W.; Langenheim, R. L., Jr.; Wahl, F. M.** Whiterockian through Givetian chemical stratigraphy in the Arrow Canyon Range, Clark County, Nevada: Illinois Acad. Sci. Trans., v. 60, no. 4, p. 350–370, illus., tables, 1967.

The composition of each bed-level unit within top units of the Pogonip Group and the Ely Springs Dolomite, Laketown Dolomite, and Piute Formation in the Arrow Canyon Range were determined by emission spectroscopy. Magnesium, calcium, aluminum, silicon, and manganese contents are generally uniform except for Ca and Mg which occur in inverse proportion. Iron is ubiquitous but decreases markedly in abundance from the base upwards within the Pogonip and the Ely Springs Dolomite. The topmost unit of the latter, however, has a large iron content, thus supporting its lithologically closer relation to overlying Laketown Dolomite than to the remainder of the Ely Springs. Sporadic minor elements might be useful in lithologic correlation within otherwise uniform carbonate sequences.—*from* Authors' abstract

05802 **Marti, Kurt.** Isotopic composition of trapped krypton and xenon in chondrites: Earth and Planetary Sci. Letters, v. 3, no. 3, p. 243–248, illus., tables, 1967.

The isotopic composition of Kr and Xe in some carbonaceous and disequilibrium chondrites are reported. The following isotope abundances of Kr and Xe in the trapped primordial heavy rare gas component are obtained: Kr-78:Kr-80:Kr-82:Kr-83:Kr-86 = 0.01920:0.1263:0.6490:0.6507:3.230:1.000; and Xe-124: Xe-126: Xe-128:Xe-130: Xe-131:Xe-132: Xe-134:Xe-136 = 0.00452:0.00406:0.0809: Xe-132: Xe-134:Xe-136 = 0.00452:0.00406: 0.0809:0.1613:0.815: 1.000: 0.381: 0.320. 0.1613:0.815:1.000:0.381:0.320. The trapped gasses are compared with those in the terrestrial atmosphere. The nature of the anomalies is discussed.—Author's abstract

05782 **Martin, Dean F.** Coordination chemistry of the oceans, [Chap.] 12 *in* Equilibrium concepts in natural water systems—Am. Chem. Soc., 151st Ann. Mtg., Pittsburgh, 1966, Div. Water, Air and Waste Chemistry Symposium: Washington, D.C., Am. Chem. Soc. (Adv. Chemistry Ser. 67), p. 255–269, illus., tables, 1967.

The coordination chemistry of sea water represents a new and useful approach to understanding the chemical properties of sea water. The coordination chemistry of sea water differs from the contemporary coordination chemistry in the following respects: most complexes involve pretransition metals, most complexes are labile, the ligands are simpler (water, hydroxide, chloride, carbonate, sulfate), and time and space are important parameters. Principles of coordination chemistry are applied to contemporary research in marine science in four areas: analysis of constituents of natural waters, the nature of metallic species in the oceans, the Red Tide problem, and carbonate geochemistry.—Author's abstract

Mason, Brian. *See* Fredriksson, Kurt. 05952

05553 **Matthews, Barry.** Late Quaternary marine fossils from Frobisher Bay (Baffin Island, N.W.T., Canada): Palaeogeography, Palaeoclimatology, Palaeoecology, v. 3, no. 2, p. 243–263, illus., tables, 1967.

Eighteen species of fossil marine pelecypods and eighteen species of Foraminifera from raised beaches (27,48,77 feet above sea level) yield evidence of post-glacial changes in the marine environment. Some are no longer in Arctic waters; some are reported for the first time in the raised beaches. A more favorable environment is suggested during the Atlantic climatic phase. Temperate Foraminifera at the 21-ft level point to warmer conditions 6000–6500 years B.P. C-14 dates of approximately 6100 to 6500 years B.P. on shells at the 48- and 11-ft levels are determined. Frobisher Bay was deglaciated at least 6500 years ago and the other date suggests rebound of about 1 ft per century for 6000 years.—*from* Author's summary

Maughan, E. K. *See* Sheldon, R. P. 05456

McBride, Earle F. *See* Lindemann, William L. 05935

05960 **McCorkell, R.; Fireman, E. L.; Langway, C. C., Jr.** Aluminum-26 and beryllium-10 in Greenland ice: Science, v. 158, no. 3809, p. 1690–1692, tables, 1967.

Activities of Be-10 and Al-26 dissolved in 200-year-old Greenland ice were found to be $18.4\ (+8.4, -4.8)\times10^{-6}$ and $3.2\pm0.9\times10^{-7}$ dpm per l, respectively. Production rates of these isotopes are calculated to be $3.6\ (+1.6, -0.9)\times10^{-2}$ and $1.7\pm0.5\times10^{-4}$ atom per sec sq cm, in agreement with rates calculated for cosmic ray production of these isotopes in the atmosphere. Probably all the Al-26 in the ice is accounted for by such atmospheric production; however, an upper limit for the influx of cosmic dust bearing Al-26 is calculated as 3.2×10^{5} tons per yr for Earth. Only upper limits could be found for Al-26 and Be-10 in the undissolved particulate matter in the ice; their addition to the activities of the dissolved material leaves unchanged the conclusions drawn here.—DBV

05871 **McCutcheon, Richard.** The evolution of Pelee Island: Ontario Geography, no. 1, p. 12–27, illus., 1967.

The outline of the physical evolution of Pelee Island in western Lake Erie southwest of Point Pelee, Ontario is described. A brief discussion of the geological structure of the island is followed by a more intensive account of past and present geomorphic processes as they appear to have affected the island. This account is based on an examination of the available literature and on brief field examination of the island during October, 1965.—Author's abstract

05453 **McCutcheon, Thomas E.** George County clay tests, *in* George County geology and mineral resources: Mississippi Geol. Econ. and Topog. Survey Bull. 108, p. 153–190, illus., tables, 1967.

The clays of George County offer development opportunities in the field of heavy clay products in both the plastic and dry press processes of manufacture. They are used as bond clay in various ceramic products. Other uses as in foundry application, mineral, vegetable, and naval stores purification and drilling mud are significant. Beneficiation of the Pascagoula clays would likely result in a product to compete with or replace bentonite.—Author's abstract

05908 **McEvilly, T. V.; Bakun, W. H.; Casaday, K. B.** The Parkfield, California, earthquakes of 1966: Seismol. Soc. America Bull., v. 57, no. 6, p. 1221–1244, illus., tables, 1967.

The epicentral region of the Parkfield earthquake sequence of 1966 is one of the three most seismic areas along the San Andreas fault, and is characterized by a relatively high incidence of large earthquakes in proportion to smaller shocks compared to the other active zones. At least 95 percent of the earthquakes, including the three largest, have P-wave radiation patterns consistent with right lateral transcurrent motion on the San Andreas fault. The shocks fall very closely along the fault trace. Earthquakes in the main shock region account for about 75 percent of the total strain release, the principal shock ($M = 5.5$) contributing about 25 percent. The region is characterized by high incidence of large aftershocks, extensive area of aftershock activity (27 km south of the main shock), and average focal depths near 5 km.—DBV

McEvilly, Thomas V. *See* Filson, John. 05909

00138 **McGilchrist, C. A.; Woodyer, K. D.; Chapman, T. G.** Recurrence intervals between exceedances of selected river levels—[Pt.] 1, Introduction and a Markov model: Water Resources Research, v. 4, no. 1, p. 183–189, illus., tables, 1968.

Analysis of the frequency of exceedance of low river levels requires the examination of conditional probabilities. A first-order Markov model is selected as a first approximation of the probability of exceedance of a selected stage for daily maximum water levels. Confidence limits are calculated on this basis.—Authors' abstract

McGlasson, Ed. H. *See* Rodgers, Elton E. 00098

McGowen, J. H. *See* Fisher, W. L. 05947

00041 **McGuinness, C. L.** National importance of ground water: Ground Water, v. 6, no. 1, p. 2–4, 1968.

The importance of ground water in the United States is shown by the fact that 400–500 billion gallons a day are discharged to streams. Ground-water reservoirs have four big uses: for water supply (withdrawal has doubled in the last 15 yr), to supply saline water for desalting, for storage of surplus surface water in place of surface reservoirs, and for waste disposal. Storage of surplus water requires artificial recharge on an enormous scale, which may not be practical, but if it is, it could meet requirements for the year 2000 and beyond. All four uses must be based on solid hydrologic information, which needs to increase faster than the rates of use.—ESL

05689 **McIlwaine, William H.** Age and origin of the Perry Formation, Charlotte County, New Brunswick, Canada: Maritime Sediments, v. 3, nos. 2–3, p. 56–60, illus., tables, 1967.

The Perry Formation is a sequence of red siltstones, sandstones, and conglomerates with interbedded basalt flows and minor tuffs, and on the basis of fossil flora is Upper Devonian in age. Petrologic descriptions are given, and sedimentary structures, paleocurrents, and paleogeography are discussed; statistical results are tabulated, and rose diagrams of paleocurrent distribution are included.—ESL

05595 **McKay, James Hughes, Jr.** Measuring the change of storage of ground water [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1947B–1948B, illus., table, 1967.

05473 **McKelvey, V. E.; Williams, James Steele; Sheldon, R. P.; Cressman, E. R.; Cheney, T. M.; Swanson, R. W.** The Phosphoria, Park City, and Shedhorn Formations in western phosphate field, *in* Anatomy of the western phosphate field—Intermountain Assoc. Geologists, 15th Ann. Field Conf. 1967: Salt Lake City, Utah, Intermountain Assoc. Geologists, p. 15–33, illus., 1967.

This is a condensed version of papers published in 1956 and 1959 in which a plan of nomenclature was developed to describe the Phosphoria and Park City Formations and their partial correlatives in the western phosphate field: (1) The name Phosphoria Formation is retained for the chert–mudstone–phosphorite facies; rocks of these lithologies that interfinger with sandstones and carbonate along the fringe of the phosphate field are identified as tongues of the Phosphoria. (2) Park City Formation is retained for the sequence of carbonate and sandstone in Utah, and similar carbonate in west-central Wyoming and carbonate tongues in Idaho, western Wyoming, and Montana. (3) Shedhorn Sandstone is introduced for sandstones of Phosphoria age in northwestern Wyoming and adjacent Montana.—KAS

05618 **McKelvey, Vincent E.; Carswell, Louis D.** Uranium in the Phosphoria Formation, *in* Anatomy of the western phosphate field—Intermountain Assoc. Geologists, 15th Ann. Field Conf. 1967: Salt Lake City, Utah, Intermountain Assoc. Geologists, p. 119–123, illus., tables, 1967.

Nearly all the phosphatic beds of the Phosphoria Formation are uraniferous, but their uranium content ranges from about 0.001 to 0.065 percent. Most differences in uranium content of the phosphate rocks cannot be correlated with other observable differences in their physical or chemical properties. As a rule, beds composed of pellets and oolites are more uraniferous than those composed of shells and other organic remains. Highly weathered beds contain less uranium than their unweathered equivalents. Most of the uranium seems to occur in carbonate fluorapatite, where it probably substitutes for calcium.—*from* Authors' abstract

05971 **McKenzie, Dan P.** Some remarks on heat flow and gravity anomalies: Jour. Geophys. Research, v. 72, no. 24, p. 6261–6273, illus., table, 1967.

Heat flow anomalies on the oceanic ridges and the large free air gravity anomalies observed from the Earth's surface and from satellites are often believed to be surface expressions of high temperatures and flow within the mantle. A simple model for the temperature within a spreading sea floor can, however, reproduce the shape and magnitude of the observed anomalies. Thus, it is not necessary for the upper mantle to be hotter beneath ridges than it is elsewhere. A similar model may be used to relate the free-air gravity anomaly to the stress in the lithosphere. The results show that long-wavelength harmonics of the external gravity field cannot be supported by the strength of the lithosphere. Most free-air anomalies observed on the surface can be maintained in this way, except possibly the largest of those over the trenches.—Author's abstract

00144 **McLerran, J. H.** Infrared sensing of soils and rocks: Materials Research and Standards, v. 8, no. 2, p. 17–21, illus., 1968.

Infrared imagery does show terrain features. However, to interpret the imagery one must be aware of the environmental factors that affect the ever-changing thermal pattern of a terrain. Infrared imagery is used to illustrate soil and rock features that have distinctive infrared signatures. Before infrared sensing becomes a useful technique, there must be considerably more study of the soil physical factors that influence the emissivity and thereby the radiation that is sensed.—Author's abstract

05720 **Mead, William E.** Evaluation of site environmental factors for major structures [abs.]: Mining Eng., v. 19, no. 12, p. 27, 1967.

00096 **Mear, Charles E.** Stratigraphy of Permian basin [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 52, no. 1, p. 198, 1968; Shale Shaker, v. 18, no. 5, p. 100, 1968.

05874 **Medina Rivero, Flavio.** Un método de investigación geohidrológica para zonas aridas: Geología i Metalurgia, v. 3, no. 21, p. 57–77, illus., table, 1967.

A graphical method leading to reasonable hydrogeologic investigations was tried with 538 analyses of ground water in a semiarid area of 12,500 km in San Luis Potosí, Mexico. The analyses are separated on semilogarithmic diagrams into characteristic calcomagnesian, calcosodic, mixed, gypsiferous, and saline waters. The triangular diagram of Villalobos (1962) aids in obtaining the geochemical relationships to the rocks with which these waters come in contact, briefly described in the text. To establish the zone of underground drainage or location of the aquifer, it is necessary to measure water levels, temperatures, and altitudes. As soon as topographic and geologic data are gathered hydrogeologic maps can be made. GDC

00146 **Megerian, Edmond; Pentland, Ralph L.** Simulation of Great Lakes basin water supplies: Water Resources Research, v. 4, no. 1, p. 11–17, illus., tables, 1968.

The basic concept utilized in the simulation study is to evaluate statistically the recorded supplies to isolate the two components assumed to constitute the basin water supply: 1) that portion of the supply considered random owing to chance interaction of unpredictable meteorological elements, and 2) that portion of the supply that is the result of the persistence due to natural storage in lakes, soil, bedrock, and snow over the drainage basin. Consideration was given also to the relation between supplies in neighboring basins. These factors were used to formulate mathematical models for simulation of supplies to all of the Great Lakes simultaneously. Extensive statistical tests were used to ensure that statistical parameters and time series characteristics of the simulated data resemble those of the recorded data.—*from* Authors' abstract

05566 **Mehringer, Peter J., Jr.** Late Quaternary vegetation in the Mohave Desert (U.S.A.): Rev. Palaeobotany and Palynology, v. 2, nos. 1–4, p. 319–320, 1967.

Pollen and C-14 dates in Nevada and California from alluvium, playa cores, and ancient spring deposits show that the present vegetation zones were reduced by 1,000 m during the maximum Wisconsin glaciation. Southward vegetational shifts of several hundred kilometers are shown. Other vegetational changes of less magnitude also are discussed.—*from* Author's summary

05865 **Melankholina, Ye. N.** Skladchataya sistema Nevadid yuzhnykh Kordil'er: Akad. Nauk SSSR Geol. Inst. Trudy, n. ser., no. 180, 69 p., illus., 1967.

The geology of the Sierra Nevada Range, Klamath Mountains, Peninsular Ranges, eastern Transverse Ranges, Mojave Desert, and Great Basin is summarized and compared on the basis of information from more than 90 references from North American and some Russian literature.—VSN

05915 **Mercy, Edward; O'Hara, M. J.** Distribution of Mn, Cr, Ti and Ni in co-existing minerals of ultramafic rocks: Geochim. et Cosmochim. Acta, v. 31, no. 12, p. 2331–2341, tables, 1967.

Samples of ultramafic and eclogitic rocks and their constituent minerals have been analysed for Mn, Cr, Ti, and Ni by colorimetric methods. The distribution of these

minor elements is mineralogically dependent, and regional and/or environmental differences are noted in the abundances of Mn and Ti. The distribution of Cr among the constituent minerals of garnet-peridotites also appears to have a regional and/or environmental character.—*from* Authors' abstract

05796 **Mercy, Edward L. P.** Geochemistry of the mantle, Chap. 13 *in* The Earth's mantle (T. F. Gaskell, editor): London and New York, Academic Press, p. 421–443, tables, 1967.

Chemical composition of the mantle may be established from petrogenetic theory and compared with data from extra-terrestrial sources. Rival hypotheses on the nature of the M-discontinuity are contrasted. The utility of a chondrite Earth model must be related to conflicting hypotheses concerning the origin and composition of chondrites. Significance of the distribution of trace elements in various groups of chondrites is little understood. Heat flow data and models of the distribution of radioactive elements within the Earth provide an alternative approach to the study of mantle composition.—JPF

05634 **Meszoely, Charles A. M.** A new cryptobranchid salamander from the Early Eocene of Wyoming: Copeia 1967, no. 2, p. 346–349, illus., 1967.

Piceoerpeton willwoodensis, n.gen., n.sp., from the Lower Eocene [Willwood Formation, near Ralston, Park County] Wyoming, is the earliest known fossil representative of the family Cryptobranchidae [Amphibia, Caudata]. The unique specimen, a trunk vertebra, bears the closest resemblance to vertebrae of [Oligocene–Recent] genus *Andrias*; however, the differences between *Piceoerpeton and Andrias* are much more pronounced than between the two Recent genera *Cryptobranchus and Andrias*.—Author's abstract

05593 **Meszoely, Charles Aladàr Mária.** North American fossil anguid lizards [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1792B–1793B, 1967.

05698 **Meyer, P. A.** Aeromagnetic survey over the Tenmile Range, Summit County, Colorado [abs.]: Mining Eng., v. 19, no. 12, p. 35, 1967.

00053 **Meyerhoff, A. A.** Memorial to Joseph Poyer Deyo Hull (1889–1967): Am. Assoc. Petroleum Geologists Bull., v. 52, no. 1, p. 174–175, portrait, 1968.

05944 **Meyerhoff, A. A.** Future hydrocarbon provinces of Gulf of Mexico–Caribbean region, *in* Symposium on the geological history of the Gulf of Mexico, Antillean–Caribbean region: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 217–260, illus., 1967.

Generalized maps of the Gulf–Caribbean region show the geological history from Precambrian to present, including structural belts. Twenty-eight different places are suggested as potential petroleum provinces; however, not all of the areas listed have the same potential. Considering those areas where twenty or less wells have been drilled, more than 250,000 sq mi (more than Texas) remain unexplored. More than 500,000 additional square miles have not been explored adequately.—HRC

Mickelson, R. H. *See* Benz, L. C. 00141

05755 **Middleton, G. V.** The Tukey Chi-Square Test—A correction [to 1965 paper]: Jour. Geology, v. 75, no. 5, p. 640, 1967.

A previously published formula (Middleton, ibid., v. 73, p. 547–549, 1965) for use in the Tukey Chi-Square Test with ungrouped data is corrected, and reference is given to a previously published proof of the Test.—ATM

Miller, Hendrick. *See* Lidz, Barbara. 00115

Miller, Stanley L. *See* Bada, Jeffrey L. 00120

05628 **Milstead, William W.** Fossil box turtles (*Terrapene*) from central North America, and box turtles of eastern Mexico: Copeia 1967, no. 1, p. 168–179, illus., tables, 1967.

A large amount of fossil material from central U.S. is here assigned to two species: *Terrapene ornata*, middle Pliocene to Recent, and *T. carolina*, Pleistocene–Recent. *T. ornata longinsulae* is an extinct subspecies from middle Pliocene to Aftonian of Kansas; fossils of extant *T. o. ornata* occur in late Pleistocene of New Mexico. Oldest subspecies of *T. carolina*, extinct *T. c. putnami*, occurs in pre–Sangamon deposits of Texas and Kansas. It is suggested that this subspecies occupied a coastal plain environment extending far inland and Pleistocene climatic changes led to its differentiation into *T. c. major* in the southeast and *T. c. triunguis* in the west. Most of the late Wisconsin fossils belong to the latter subspecies which now occupies most of central U.S. Three isolated Recent subspecies in eastern Mexico are traced from *T. c. putnami*.—VMJ

05631 **Milstead, William W.; Tinkle, Donald W.** *Terrapene* of western Mexico, with comments on the species groups in the genus: Copeia 1967, no. 1, p. 180–187, illus., tables, 1967.

Two extant species of box turtles occur in western Mexico: *Terrapene ornata*, with one relict subspecies, and *T. nelsoni*, with two subspecies. Fossil and Recent box turtles of North America are divided into two species groups: Ornata Group, comprising subspecies of *T. nelsoni and T. ornata*, including the extinct Plio Pleistocene *T. o. longinsulae*; Carolina Group, comprising seven subspecies of *T. carolina*, including the extinct Pleistocene *T. c. putnami, and T. coahuila*. Evolution in the Ornata Group is correlated with Plio–Pleistocene climatic fluctuations in the Great Plains. *T. o. ornata* probably evolved from *longinsulae*, and *T. nelsoni* evolved from an *ornata* subspecies after crossing a mesic corridor to the west coast of Mexico; post–Wisconsin closing of the corridor initiated speciation through isolation.—VMJ

Minihan, Edward. *See* Oxley, Marvin L. 05829

Mitchell, James K. *See* Singh, Awtar. 00131

00133 **Mitchell, James K.; Campanella, Richard G.; Singh, Awtar.** Soil creep as a rate process: Am. Soc. Civil Engineers Proc., v. 94, paper 5751, Jour. Soil Mechanics and Found. Div., no. SM 1, p. 231–253, illus., table, 1968.

The fundamental equation of the theory of absolute reaction rates has been adapted for use in the study of time-dependent soil deformations. Results of constant stress creep tests have established that the basic form of this equation supports the assumption of a thermally activated creep process, the predicted relationship between experimental activation energy and creep stress, and the predicted stress dependence of creep rate. Some modification of the equation is needed, however, to account for the variation of creep rate with time. Techniques are described for study of deformation mechanisms in soils and test results suggest that interparticle bonding is probably of the primary valence type. Resistance to shear stresses cannot be accounted for in terms of viscous water films, and interparticle contacts must be effectively solid to solid.—Authors' abstract

Mitchell, R. S. *See* Terry, J. P. 05686

Mizutani, Hitoshi. *See* Kanamori, Hiroo. 00060

00158 **Mogharabi, Ataolah.** Trace elements in carbonates of the Foraker Formation (Lower Permian) in north-central Oklahoma: Oklahoma Geology Notes, v. 28, no. 1, p. 14–20, illus., table, 1968.

Trace-element analyses were made of these carbonates to determine the abundance of some common trace elements, to investigate possible information on the depositional environment, and to determine the relationship of selected elements, especially strontium, to diagenesis. Spectrochemical analyses were run on 30 samples from 7 measured sections. Concentrations of 6 elements are tabulated. Copper, vanadium, and titanium did not appear to be significant. Manganese indicated an

arid paleoclimate. The strontium content was lower and manganese content greater in dolomitized samples. Zirconium was found in five samples and correlated with the insoluble residues.—ESL

Mohler, Hans P. *See* Hay, William W. 05923

05680 **Moncure, Richard; Nichols, Maynard.** Sediments in James estuary [abs.]: Virginia Jour. Sci., v. 18, no. 4, p. 186–187, 1967.

05805 **Monroe, E. A.** Unit cell and space group of gaylussite, $CaCO_3 \cdot Na_2CO_3 \cdot 5H_2O$: Zeitschr. Kristallographie, v. 124, no. 6, p. 459, 1967.

The space group and unit cell of gaylussite have been determined for crystals from Searles Lake, Calif. The new data are: space group $I\ 2/a$; unit cell dimensions, $a = 11.59$ A, $b = 7.77$ A, $c = 11.19$ A, $\beta = 101°55'$; $a:b:c = 1.4916:1:1.4401$.—ESL

05736 **Moorbath, S.** Recent advances in the application and interpretation of radiometric age data: Earth-Sci. Rev., v. 3, no. 2, p. 111–133, illus., table, 1967.

This review is concerned with different types of concordant and discordant mineral and whole rockage patterns produced in terrains with simple cooling history and in those which have been subjected to more than one thermal episode. This leads to a discussion of the geological significance, if any, of radiometric dates obtained on different minerals and rocks by various techniques as well as the validity of histograms in geochronology. Several published case histories are described including the Appalachian belt and the eastern Great Basin of Nevada and Utah which serve as examples.—*from* Author's summary

05974 **Moore, Carleton B.; Lewis, Charles F.** Total carbon content of ordinary chondrites: Jour. Geophys. Research, v. 72, no. 24, p. 6289–6292, illus., tables, 1967.

The total carbon content of 86 ordinary chondrites has been determined by an oxygen combustion–gas chromatographic analysis technique. Values obtained range from 0.016 to 0.57 wt percent carbon. Most ordinary chondrites in all groups have carbon contents lower than 0.20 wt percent. Unequilibrated ordinary chondrites often have carbon contents greater than 0.20 wt percent. There appears to be a general trend indicating that more meteorites with high concentrations of total carbon occur in the less metamorphosed chondrites, as indicated by the petrologic types of Van Schmus and Wood [1966].—Authors' abstract

05831 **Moore, Clyde H., Jr.** Stratigraphy of the Edwards and associated formations, west-central Texas: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 61–75, illus., 1967.

The Antlers quartz sandstone underlies a carbonate sequence which can be conveniently divided into two subdivisions: a northern area, and a southern or Edwards Plateau area. In the northern area, the Antlers is overlain by the Walnut–Comanche Peak units, a marl; this in turn is overlain by the rudistid-bearing Edwards Limestone which also is the only unit present over the Antlers on the southern Edwards Plateau. Between these two areas there occurs, over the Antlers, the Edwards and then an unnamed carbonate sequence over this. This same unnamed carbonate occurs over the Edwards in the northern area also.—HRC

00086 **Moore, Paul B.; Bennett, J. Michael.** Kornerupine—Its crystal structure: Science, v. 159, no. 3814, p. 524–526, illus., tables, 1968.

Three-dimensional analysis of the crystal structure of kornerupine yields a crystallochemical formula much more complicated than that usually given in mineralogy texts. The unusual crystal structure includes walls of Al–O edge- and corner-sharing octahedra, and chains of alternating Mg–O and Al–O octahedra fused to the walls by further edge-sharing to form dense slabs. These slabs are held together by $[Si_2O_7]$ corner-sharing tetrahedral pairs and $[(Al,Si)_2SiO_{10}]$ corner-sharing tetrahedral triplets.—DBV

Morales-Alamo, Reinaldo. *See* Haven, Dexter S. 05625

Morales-Alamo, Reinaldo. *See* Haven, Dexter S. 05677

05749 **Morelock, Jack; Koenig, Karl J.** Terrigenous sedimentation in a shallow water coral reef environment: Jour. Sed. Petrology, v. 37, no. 4, p. 1001–1005, illus., table, 1967.

A series of grab samples of sediments from inter-reef areas surrounding the coral reefs at Anton Lizardo, southeast of Vera Cruz, Mexico, was examined and analyzed for composition and various grain properties. Most of the sediment cover was determined to be terrigenous, with only a little carbonate material included. It is considered to be largely of pre-Wisconsin age, probably deposited while the area was exposed to subaerial processes.—EDM

05811 **Morgan, J. W.; Lovering, J. F.** Rhenium and osmium abundances in some igneous and metamorphic rocks: Earth and Planetary Sci. Letters, v. 3, no. 3, p. 219–224, illus., tables, 1967.

Rhenium and osmium abundances in 14 igneous and metamorphic rocks are reported. The values found range between 0.1 and 24×10^{-10} g/g Re and ≤ 0.2 to 59×10^{-10} g/g Os. The two are inversely correlated and this is especially noticeable from basalt fragments from a breccia pipe in New South Wales. The highest Os abundances are in ultrabasic rocks but apart from this there is no systematic variation of abundance with rock type. Re abundances in common surface igneous rocks are reasonably constant and a value of $5\pm3\times10^{-10}$ g/g Re is probably a close estimate of the abundance in the upper levels of the crust.—*from* Authors' abstract

05776 **Morgan, James J.** Applications and limitations of chemical thermodynamics in natural water systems, [Chap.] 1 *in* Equilibrium concepts in natural water systems—Am. Chem. Soc., 151st Ann. Mtg., Pittsburgh, 1966, Div. Water, Air and Waste Chemistry Symposium: Washington, D.C., Am. Chem. Soc. (Adv. Chemistry Ser. 67), p. 1–29, illus., 1967.

Studying thermodynamic relationships at constant temperature and pressure permits comparison between actual chemical composition of a natural water system and the equilibrium composition of a model closed system. Comparing the composition of the equilibrium model with that of the actual natural water system is an important step in understanding the real system. In contrast to closed-system models, for which the time-invariant state is equilibrium, the stationary state is the corresponding state of open systems. Three different chemical systems in natural waters illustrate these principles: homogeneous and heterogeneous buffer capacities in natural waters, hydrolysis reactions of aqueous aluminum, and the oxidation of reduced manganese by oxygen.—Author's abstract

05783 **Morris, J. Carrell; Stumm, Werner.** Redox equilibria and measurements of potentials in the aquatic environment, [Chap.] 13 *in* Equilibrium concepts in natural water systems—Am. Chem. Soc., 151st Ann. Mtg., Pittsburgh, 1966, Div. Water, Air and Waste Chemistry Symposium: Washington, D.C., Am. Chem. Soc. (Adv. Chemistry Ser. 67), p. 270–285, illus., table, 1967.

Equilibrium models are valuable in interpreting stability relations of pertinent redox components in natural water systems, but concentrations of oxidizable or reducible species may be far from thermodynamic predictions as many redox reactions are slow. Maintenance of life resulting directly from a steady input of solar energy is also a major cause of nonequilibrium conditions. Nonphotosynthetic organisms, however, tend to restore equilibrium by catalytically decomposing unstable ultimate products of photosynthesis. Measuring redox potentials frequently yields results not amenable to unambiguous interpretation. Quantitative interpretation with respect to solution composition is frequently not justified because required electrochemical reversibility is usually not attained. The point of zero-applied current is not necessarily the equilibrium potential; most Eh-measurements on natural waters represent mixed potentials.—*from* Authors' abstract

Motts, Ward S. *See* Neal, James T. 05762

Moulton, Beatrice. *See* Raitt, Helen. 05867

05958 **Mountjoy, Eric W.** Triassic stratigraphy of northern Yukon Territory: Canada Geol. Survey Paper 66–19, 44 p., illus., 1967.

Triassic strata occur in three widely separated localities: the British and Barn Mountains, Richardson Mountains, and northwestern Ogilvie Mountains. Triassic strata are most abundant in the British Mountains where the Lower Triassic Sadlerochit Formation and Upper Triassic Shublik Formation are represented. The Richardson Mountain strata consist of marine limestones except for non-marine sediments near Rat River. A thicker sequence of black shales with thin limestone interbeds occurs in the Ogilvie Mountains. During Triassic time most of the region seems to have been moderately positive with some relief except for areas of the British and Barn Mountains and northwestern Ogilvie Mountains.—MST

05707 **Moxham, Robert M.; Greene, Gordon W.; Harvey, A. H.** Aerial and bore-hole thermal surveys at coal mine fires, Pa. [abs.]: Mining Eng., v. 19, no. 12, p. 35, 1967.

Mudge, M. R. *See* Knight, Richard R. 05637

05760 **Mueller, Robert F.** Mobility of the elements in metamorphism: Jour. Geology, v. 75, no. 5, p. 565–582, illus., tables, 1967.

Mobility of elements in metamorphism is discussed in terms of lattice diffusion, which brings about local equilibrium during recrystallization creep by differential stresses, and intergranular vapor transport. Compositions of individual metamorphic minerals vary continuously with distance, but far less than the variation in modal phase content that gives rise to gneissic banding. A quasi-equilibrium model of diffusion in small volumes of rock in local equilibrium is used to interpret the nature of these variations. Flux of H_2 in cummingtonite-bearing rocks, producing variation in the atomic fraction $Mg/(Mg+Fe)$, is an example.—*from* Author's abstract

05702 **Munk, Miner N.** Neon, argon, krypton, and xenon compositions of the Misteca and Carbo iron meteorites: Earth and Planetary Sci. Letters, v. 3, no. 2, p. 133–138, illus., tables, 1967.

The neon, argon, krypton, and xenon compositions in the medium octahedrites Misteca and Carbo are reported. A Xe-129 component, and to a lesser extent, a Xe-131 component in the excess of trapped and spallation components in Carbo xenon are observed. Otherwise, the rare gas compositions can be understood in terms of a cosmic ray spallation component and a trapped component of atmospheric isotopic composition. The same agreement is seen between observed and calculated spallation compositions as seen earlier in the Costilla Peak medium octahedrite; the observed differences in the three meteorites are attributed to different degrees of cosmic ray shielding.—*from* Author's abstract

Murray, Bertram G., Jr. *See* Ford, Norman L. 05660

05668 **Murray, Frederick N.** A computer method for converting oriented geologic data to radian measure in a spherical coordinate system: Illinois Acad. Sci. Trans., v. 60, no. 4, p. 340–349, illus., 1967.

Conversion of geologic compass directions and dip designations to radians is often required for mathematical treatment of oriented data by computer. The method described here permits a geologist to record the data read directly from a Brunton pocket transit in the conventional manner. Data recorded directly on a coding form or in an orderly fashion in field books may be readily key punched. A computer program subroutine that performs the conversion is described.—Author's abstract

05890 **Murray, G. F.** Note on strong motion records from the June 1966 Parkfield, California, earthquake sequence: Seismol. Soc. America Bull., v. 57, no. 6, p. 1259–1266, illus., 1967.

Data are presented for all of the June 1966 Parkfield, California, earthquakes that were recorded by five strong motion accelerographs in the Shandon–Cholame area south of Parkfield. The instrument array is generally transverse to the fault, intersecting it just north of the southern limit of the June surface fractures. Unique seismograms were obtained of small shocks during wave motion from the principal earthquake; in the three minutes following the onset at 0426, June 28 GMT, two of the strong motion instruments recorded completely ten different earthquakes. Approximate epicenters are located for 13 of the earthquakes.—Author's abstract

00064 **Murray, G. H., Jr.** Quantitative fracture study—Sanish pool, McKenzie County, North Dakota: Am. Assoc. Petroleum Geologists Bull., v. 52, no. 1, p. 57–65, illus., table, 1968.

The Devonian Sanish pool is on the steep northeast flank of the Antelope anticline in the central Williston basin. Unique features—high productivity from wells in the dolomite–shale facies of the "Sanish Sand" zone, very high initial reservoir pressure, and almost complete absence of water production—suggest that productivity is a function of tension fracturing. Fracture porosity varies directly as the product of bed thickness times structural curvature, and fracture permeability varies as the third power of this product. The overlying Bakken Shale is the immediate, and ultimate, oil source; the Sanish fracture system gathers the oil. Very high initial reservoir pressure indicates that Sanish–Bakken accumulation is in an isolated, oil-saturated reservoir independent of structure in the normal sense. The Bakken Shale beds are believed to be everywhere oil saturated.—BHK

Murray, Grover E. *See* Durham, C. O., Jr. 05954

05859 **Murray, Marian.** Hunting for fossils—A guide to finding and collecting fossils in all fifty States: New York, The Macmillan Co., 348 p., illus., table, 1967.

Introductory material includes paleontological problems and rules of collecting, a chart of geologic ages, and an explanation of classification. Six chapters cover: what fossils are all about, the rock and how it got there, invertebrates, plant fossils, finding and care of fossils, and collecting. Two-thirds of the book is occupied by fifty chapters on states, giving collecting locations for each state by ages. The book concludes with a glossary, bibliography, lists of museums displaying fossils, of colleges offering courses in vertebrate paleontology, and of state geological surveys.—ESL

05754 **Murray, Stephen Patrick.** Control of grain dispersion by particle size and wave state: Jour. Geology, v. 75, no. 5, p. 612–634, illus., tables, 1967.

The dispersion of three sizes of tagged grains normal to the shoreline by shoaling wind waves was studied in Buzzards Bay, Mass. Within the experimental range of data, it is concluded that under the same wave conditions finer grain sizes have a greater tendency to move offshore than coarser grains. A change in wave state, resulting in an increase in the maximum horizontal velocity near the bottom, produces an increase in the tendency for all test grain sizes to move seaward. Theoretical concentrations computed from the equations of turbulent diffusion of contaminant particles in the atmosphere agree qualitatively with the empirical observations of this study and suggest possible explanations.—*from* Author's abstract

05932 **Myers, John C.** Demand and supply of free world sulphur and future additional reserves [abs.]: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 143, 1967.

05818 **Nagy, Bartholomew.** The possibility of extraterrestrial life—Ultra-microchemical analyses and electron-microscopic studies of microstructures in carbonaceous meteorites: Rev. Palaeobotany and Palynology, v. 3, nos. 1–4, p. 237–242, illus., 1967.

There are a few stony meteorites which are composed of clay-type minerals, carbonates, oxides of iron, gypsum, magnesium sulfate, elementary sulfur and organic matter, and which contain as much as 20 percent water, part of which has deuterium/hydrogen ratios entirely different from those of terrestrial waters. The meteorites also show microstructures (i.e., organized elements) which morphologically resemble microfossils. Electron probe X-ray microanalysis, acid insoluble residues, and ultra-thin section studies of a carbonaceous meteorite are made, and small, rounded objects, occasionally with double walled structures, are described. These are firmly embedded in the mineral matrix of the meteorite; their nature is unknown.—*from* Author's summary

Nalwalk, A. J. *See* Fridel, R. A. 00114

05586 **Nalwalk, Andrew Jerome.** Geology of the north wall of the Puerto Rico Trench [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1995B-1996B, 1967.

05708 **Nash, J. T.; Kerr, P. F.** Uranium deposits in the Jackpile Sandstone, New Mexico [abs.]: Mining Eng., v. 19, no. 12, p. 40, 1967.

05733 **Naylor, Richard Stevens.** A field and geochronologic study of mantled gneiss domes in central New England [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1996B, 1967.

05762 **Neal, James T.; Motts, Ward S.** Recent geomorphic changes in playas of western United States: Jour. Geology, v. 75, no. 5, p. 511-525, illus., tables, 1967.

Features on playas show recognizable changes in response to long- and short-term shifts in factors that affect water availability. Giant polygonal cracks, sinkholes, relict spring mounds, and dead phreatophyte mounds have resulted from lowering of the piezometric surface caused by long-term climatic shifts and increase in man's use of water. The same factors cause modifications of the vegetation cover that result in expansion of playas and increased erosion. Short-term changes mainly affect small features on playa surfaces.—DRM

Nemickas, Bronius. *See* Vecchioli, John. 05863

00153 **Neuman, Shlomo P.; Witherspoon, P. A.** Theory of flow in aquicludes adjacent to slightly leaky aquifers: Water Resources Research, v. 4, no. 1, p. 103-112, illus., 1968.

The theory of flow in aquicludes adjacent to slightly leaky aquifers is presented for two cases: a) aquicludes of finite thickness, and b) aquicludes of semi-infinite thickness. By 'slightly leaky' we mean that when the aquifer is being pumped at constant rate, the drawdowns in it will be predicted by the Theis solution, even though some slight movement of water through adjacent confining beds occurs. It is assumed that flow is essentially horizontal in the aquifer and vertical in the aquiclude. On this basis, analytical expressions for drawdown in the aquiclude are developed for each case. The results are presented as type curves that can be used for aquiclude evaluation. The effect of multiple-well fields is considered in each case.—*from* Authors' abstract

05466 **Newcomb, J. J.** Elk Valley area, Caribou County, Idaho, *in* Anatomy of the western phosphate field—Intermountain Assoc. Geologists, 15th Ann. Field Conf. 1967: Salt Lake City, Utah, Intermountain Assoc. Geologists, p. 267-270, illus., geol. map, 1967.

The Nugget Sandstone (Jurassic) was the primary target of a well drilled by the Amerada Petroleum Corporation. Two gas shows were recorded in the Twin Creek but analysis of well cuttings indicated low porosity and permeability. Salty water was recovered from the Nugget Sandstone.—KAS

05654 **Newell, Norman D.** Revolutions in the history of life, *in* Uniformity and simplicity—A symposium on the principle of the uniformity of nature: Geol. Soc. America Spec. Paper 89, p. 63-91, illus., tables, 1967.

The purpose of this essay is to demonstrate that the history of life from the fossil record shows that it has been marked by brief episodes of exceptionally high rates of extinction commonly accompanied and followed by somewhat more gradual evolutionary recovery. All evidence indicates that episodes of mass extinction may occur within a few hundreds or thousands of years, while the development of a new replacing fauna probably requires hundreds of thousands or millions of years. Nothing in the record gives support to catastrophism, as Cuvier understood it, nor to the literal uniformity of Lyell which emphasized slow and uniform rather than episodic changes.—MST

05567 **Nichols, H.** Central Canadian palynology and its relevance to northwestern Europe in the late Quaternary Period: Rev. Palaeobotany and Palynology, v. 2, nos. 1–4, p. 231–243, illus., 1967.

Pollen and macroscopic plant debris from Keewatin and Manitoba, in the tundra and the northern edge of the boreal forest, show that organic accumulation began 6500–8000 yr B.P. when *Picea* colonized bare ground. The forest originally extended farther north by 300 km and has fluctuated, showing climatic changes since the ice has abandoned the area. C-14 values in the peat show similar changes to those from northwestern Europe at the same time.—*from* Author's summary

Nichols, Maynard. *See* Moncure, Richard. 05680

05681 **Nichols, Maynard M.** Academy cruise on the James estuary [abs.]: Virginia Jour. Sci., v. 18, no. 4, p. 187, 1967.

Nichols, William D. *See* Vecchioli, John. 05863

05682 **Noble, D. F.** Mineralogical aspects of the Hollins Slide [abs.]: Virginia Jour. Sci., v. 18, no. 4, p. 187, 1967.

05563 **Norton, Norman J.; Hall, John W.** Guide sporomorphae in the Upper Cretaceous–Lower Tertiary of eastern Montana (U.S.A.): Rev. Palaeobotany and Palynology, v. 2, nos. 1–4, p. 99–110, illus., 1967.

Fourteen sporomorphae are listed which are characteristic of either the uppermost Cretaceous (Hell Creek Formation) or the lowermost Tertiary (Tullock Formation) of eastern Montana. Their distribution elsewhere, if any, is given also. One genus and four new species are described.—Authors' summary

05803 **Nygreen, Paul W.; Bourn, Oscar B.** Morphological variation of *Potonieisporites* in a late Pennsylvanian florule: Rev. Palaeobotany and Palynology, v. 3, nos. 1–4, p. 325–332, illus., 1967.

Monosaccate specimens from the Upper Pennsylvanian Pony Creek Shale Member of the Wood Siding Formation, Wabaunsee Group, Virgilian, in Wabaunsee County, Kans., exhibit morphological transitions from *Potonieisporites* to the genera *Candidospora, Guthoerlisporites, and Nuskoisporites*. These transitions include changes of the aperture form, inner fold arrangement, shape and limboid development of the saccus. These changes in the pollen coincide with changes noted in compressional macrofossils of early conifers.—Authors' summary

05849 **Odum, H. T.** Biological circuits and the marine systems of Texas, *in* Pollution and marine ecology—Conf., Galveston, Tex., 1966, Proc.: New York, Interscience Publishers, p. 99–157, illus., tables; discussion, p. 187–192, 1967.

Behind the long beach line of Texas, in a million acres of shallow marine waters connected only through narrow passages with the open Gulf of Mexico, distinctive ecological systems once maintained themselves. Today man's industries and population have changed these bay systems with pulsating overloads of wastes; extremes of salinity and temperature lead to incomplete biological utilization of organic matter and to increased skeletal litter. In the consumer reefs which cross many bays and fill drowned river channels, shellfish species shift with salinities and seasons. These filter feeders are complimented by surrounding plankton, coupled

by circulating waters in strong winds. In designing auxiliary energy flows, engineers should consider the natural environmental circuits.—GDC

05948 **Oesch, Ronald D.** A preliminary investigation of a Pleistocene vertebrate fauna from Crankshaft Pit, Jefferson County, Missouri: Natl. Speleol. Soc. Bull., v. 29, no. 4, p. 163–185, illus., tables, 1967.

Crankshaft Pit has yielded a valuable Pleistocene bone deposit including 73 vertebrate species of which 54 are mammals. Seven of the 54 mammals are extinct: *Megalonyx* cf. *M. jeffersoni*, a ground sloth; *Dasypus bellus*, a large armadillo; *Synaptomys* cf. *S. australis*, a bog lemming; *Brachyprotoma* sp., a skunk; *Tapirus* cf. *T. excelsus*, a tapir; *Equus* sp., a Pleistocene horse; and *Platygonus* cf. *P. compressus*, a peccary. Eleven additional Recent species had not been previously reported from Missouri. The climate must have been cooler, but with less severe winters than at present. The fauna probably dates from the latter part of the Wisconsin glacial period.—*from* Author's abstract

05888 **Oglesby, Woodson R.** A gravity profile of the south Florida shelf, *in* Symposium on the geological history of the Gulf of Mexico, Antillean-Caribbean region: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 278–286, illus., 1967.

A gravity profile from La Belle, Hendry County to Miles City, Collier County, reveals anomalies at Felda and Sunniland fields, the only two fields where oil is now produced in Florida. Sunniland field is probably a compactional anticline, with approximately 80 feet of closure and 180 feet of structural relief. The gravity anomaly overlying it is on the order of 20 gravity units. Felda field is probably a hydrodynamic trap over a nose. Structural relief of the nose is on the order of 50 feet. Poor results which have reportedly been obtained by seismic surveys in the South Florida basin indicate gravity may be the more reliable indirect method currently available for use in the area.—Author's abstract

O'Hara, M. J. *See* Mercy, Edward. 05915

O'Keefe, J. A. *See* Scheidegger, Adrian Eugen. 05972

05837 **Oldale, Harry R.** A centennial of mining exploration and development—Coxheath Hills, Cape Breton: Canadian Mining and Metall. Bull., v. 60, no. 668, p. 1411–1419, illus., 1967.

Pre-Carboniferous basement rocks are Devonian clastic rocks, Ordovician intermediate to acid intrusives, and Cambrian volcanic rocks; these are overlain by fresh water Carboniferous sediments. Metallic ores include iron, copper, molybdenum, lead, and zinc. The history of exploration and mining development since discovery of copper in 1875 is summarized.—ARK

05876 **Oles, Floyd; Oles, Helga.** Eastern gem trails—A guide to the most attractive and productive gem and mineral collecting areas of central-eastern United States: Mentone, Calif., Gembooks, 80 p., illus., 1967.

Collecting localities visited personally by the authors in New Jersey, Pennsylvania, Maryland, Virginia, and North Carolina are listed and described. Directions and data on ownership were accurate at the time of writing. All localities described are private property which usually requires specific permission of owner to enter, with no guarantee of them remaining open to collecting. Interspersed with itinerary directions are tips on conditions to be found, cautions, and equipment needed, as well as information on the rocks and minerals to be found.—GDC

Oles, Helga. *See* Oles, Floyd. 05876

Oles, Keith F. *See* Wilkinson, W. D. 00054

00104 **Olson, John P.** Coping with computers—Suggestions for survival [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 52, no. 1, p. 193, 1968; Shale Shaker, v. 18, no. 5, p. 99, 1968.

05851 **Olson, Theodore A.; Burgess, Frederick J.** (editors). Pollution and marine ecology—Conf., Galveston, Tex., 1966, Proc.: New York, Interscience Publishers, 364 p., illus., tables, 1967.

This book records the proceedings of the "Conference on the status of knowledge, critical research needs, and potential research facilities relating to ecology and pollution problems in the marine environment", made possible by a grant from the U.S. Public Health Service to the Texas A and M University and the University of Minnesota. The end goal is the development of methods for effective control of the environmental changes that accompany pollution. Three of the papers, by H. T. Odum, H. Postma, and P. L. Parker, are cited individually.—GDC

Onstad, C. A. *See* England, C. B. 00145

Ormiston, A. R. *See* Amsden, Thomas W. 00044

Östlund, G. *See* Szabo, B. J. 05741

05829 **Oxley, Marvin L.; Minihan, Edward; Ridgeway, Julius M.** A study of the Jurassic sediments in portions of Mississippi and Alabama: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 24–48, illus., 1967.

Jurassic sedimentation was influenced by a southwestward extension of the folded Appalachians, regional ancestral faulting, and salt uplift. Middle and Lower Smackover rocks are carbonates with local littoral sandstone facies. The Upper Smackover rocks contain porous sands, a dense dolomite facies, and a porous oolitic facies. Haynesville deposits include anhydrite–carbonate rocks with a shoreward, sandy facies where good porosity is present. Of the Cotton Valley, the lower Shuler facies is made of red beds of paralic origin. The overlying Dorcheat is a fine-grained clastic rock of open neritic shelf origin. Good reservoir conditions are present in both facies. Isopach, lithofacies, and stratigraphic maps are included.—*from* Authors' abstract

05580 **Page, Robert Alan, Jr.** Aftershocks and microaftershocks of the Great Alaska earthquake of 1964 [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1996B–1997B, 1967.

05913 **Palacas, James G.** Organic matter in bottom sediments, Choctawhatchee Bay, Florida [abs.], *in* Symposium on the geological history of the Gulf of Mexico, Antillean–Caribbean region: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 482, 1967.

Palmer, Allison R. *See* Robison, Richard A. 00052

05581 **Palmer, Leonard Arthur.** Marine terraces of California, Oregon and Washington [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1997B, 1967.

05759 **Parizek, Richard R.** Strike–dip indicator: Jour. Sed. Petrology, v. 37, no. 4, p. 1249–1250, illus., 1967.

A strike–dip indicator is designed to facilitate rapid determination of the orientation of surfaces in unconsolidated deposits. Made of aluminum, it contains two spirit levels to determine strike and dip directions and a graduated arm for use in determining dip angles. A Brunton compass is used in conjunction with the instrument for measuring.—EDM

Park, J. K. *See* Roy, J. L. 00079

00163 **Parker, Dana C.** Developments in remote sensing applicable to airborne engineering surveys of soils and rocks: Materials Research and Standards, v. 8, no. 2, p. 22–30, 1968.

The sensors include cameras, infrared and passive microwave mappers, radar, spectrometers, laser, radio frequency, and induction devices. The applications include identifying and delimiting soil and rock units and locating soil and rock

materials suitable for engineering purposes. The data also provide answers about surface and subsurface conditions that would affect ease of excavation, slope stability, or suitability for subgrade, foundation, or fill materials. Many potentially valuable sensors are not being exploited or considered. A big problem is that of economically converting developments in sensor technology and data interpretation into routine engineering practice. Although sensor technology imposes limits, capability could be advanced by solving problems that overshadow it, the most important of which is learning to interpret the data accurately and routinely in terms of engineering parameters.—*from* Author's abstract

05843 **Parker, Patrick L.** Chemical parameters, *in* Pollution and marine ecology Conf., Galveston, Tex., 1966, Proc.: New York, Interscience Publishers, p. 317–321, illus., tables, 1967.

One method for discriminating between natural and industrial organic pollution is based on C–14 dating of organic matter (Rosen and Ruben, 1965). The stable carbon isotope ratio C–13/C–12 is a second natural tracer for carbon; the trial study described here indicates that this ratio may be used to identify certain carbon wastes. In some major carbon reservoirs organic carbon is always negative with respect to inorganic carbon (Solenhofen limestone identified as NBS–No. 20). Petroleum, especially the natural gases such as methane and ethane, are considerably more negative than marine organisms. The gas converted into petrochemical products preserved its C–13/C–12 ratio. As petrochemical carbon mixes with normal marine carbon in a bay, the isotope of resulting mixture will be dependent on volumes, concentrations, and so forth.—GDC

Parker, Raymond L. *See* Shawe, Daniel R. 05853

00128 **Parkin, Alan K.; Gerrard, Charles M.; Willoughby, Donald R.** Deformation of sand in hydrostatic compression—Discussion [of paper 5245 by H.–Y. Ko and R. F. Scott, 1967]: Am. Soc. Civil Engineers Proc., v. 94, paper 5704, Jour. Soil Mechanics and Found. Div., no. SM 1, p. 336–340, illus., 1968.

Ko and Scott (ibid., v. 93, no. SM 3, p. 137–156, 1967) have postulated a theoretical model of uniform spheres; assuming Hertzian behaviour of contact points between the spheres under increasing pressure, a theoretical hydrostatic stress–strain relationship is derived; this was used to predict compression of a natural sand at various densities, and gave good agreement with measurements in a new triaxial apparatus. Parkin, Gerrard, and Willoughby here discuss comparable studies by several other authors, particularly their own investigations sponsored by the Australian Road Research Board, in which low–strain techniques for the triaxial apparatus are being developed. They demonstrate the importance of thorough investigation of grain orientation in naturally deposited sand before assuming any relationship between horizontal and vertical strain components.—VMJ

05773 **Parks, George A.** Aqueous surface chemistry of oxides and complex oxide minerals, [Chap.] 6 *in* Equilibrium concepts in natural water systems—Am. Chem. Soc., 151st Ann. Mtg., Pittsburgh, 1966, Div. Water, Air and Waste Chemistry Symposium: Washington, D.C., Am. Chem. Soc. (Adv. Chemistry Ser. 67), p. 121–

The isoelectric point (IEP(s)) and the zero point of charge (ZPC) are convenient references for predicting the charge–dependent behavior of oxide minerals and their suspensions. The ZPC is the pH at which the solid surface charge from all sources is zero. The IEP(s) is a ZPC arising from interaction of H^+, OH^-, the solid, and water alone. The IEP(s) of a simple oxide is related to the appropriate cationic charge and radius. The ZPC of a complex oxide is approximately the weighted average of the IEP(s)'s of its components. Predictable shifts in ZPC occur in response to specific adsorption and to changes in cation coordination, crystallinity, hydration state, cleavage habit, surface composition, and structural charge or ion exchange capacity.—Author's abstract

05978 **Parmalee, Paul W.** A recent cave bone deposit in southwestern Illinois: Natl. Speleol.Soc.Bull.,v.29,no.4,p.119–147,illus.,tables,1967.

A large bone deposit in Meyer Cave fissure in a Mississippi River bluff, Monroe County, Ill., was removed during excavations in 1959, 1960, and 1961. This fissure had functioned as a den site and natural death trap for animals since early post-glacial times. At least 115 species of vertebrates representing a minimum of 12,400 individuals, and 27 species of invertebrates (mollusks and insects), were identified. The deposit was not stratified, but recovery of elements of boreal or northern species (pigmy shrew, least weasel, red-backed and yellow-cheeked voles, porcupine) suggested a period of cool, moist climate, probably during early post-Pleistocene (10,000–8,000 B.C.). Remains of spotted skunk and wood rat reflected a later warm and dry period (4,000–1,000 B.C.).—*from* Author's abstract

Peake, E. *See* Hodgson, G. W. 05848

05709 **Pemberton, Roger H.** In-situ outcrop uranium analysis utilizing new ground radioactive spectrometers [abs.]: Mining Eng., v. 19, no. 12, p. 35, 1967.

00048 **Penn, Sheldon H.** The origin of ferro-manganese concretions in the marine environment [abs.]: Mining Eng., v. 20, no. 1, p. 91–92, 1968.

Pentland, Ralph L. *See* Megerian, Edmond. 00146

05641 **Perel'man, Aleksandr I.** Geochemistry of epigenesis (2d edition, translated by N. N. Kohanowski): New York, Plenum Press (Mons. Geoscience), 266 p., illus., tables, 1967; originally published in Russian 1965.

Subject headings of chapters are: geochemical role of living matter; geochemical parameters of elements which condition their physical and chemical migration; law of mass action in geochemistry; analysis of energy involved in supergene migration; migration of colloids; occurrence of chemical elements in the supergene zone; natural media of this zone; factors in development of these media; classification of the epigenetic processes operating in the supergene zone; epigenetic processes of oxidation; gley processes of reduction in epigenesis; epigenetic processes in reducing, sulfidic environments; geochemical barriers; development of epigenetic processes through geologic history, and conclusions.—ESL

Perez, Virgilio. *See* Cloud, William K. 05906

05977 **Perret, William R.** Deep reflections from a nuclear explosion in a salt dome: Jour. Geophys. Research, v. 72, no. 24, p. 6327–6333, illus., tables, 1967.

Data from four special gages in a boring, offset 166 m from the Salmon nuclear explosion 828 m deep in the Tatum salt dome, include five groups of reflection signals from below the source. The gages, accelerometers of high sensitivity to vertical motion, were at depths between 673 and 1,190 m. These data, interpreted by means of U.S.G.S.'s crustal study data for the Tatum dome vicinity, yield depths to Louann–basement contact of 8.23 km, an unidentified interface near 13 km, the Conrad discontinuity at 17.1 km, an interface at 33 km, and the M-discontinuity at 34.6 km. The last two reflections imply a transition zone at the crustal mantle contact. Uniqueness of these data lies in identical vertical paths from source to reflecting surface to detectors, a point source of high energy, and a vertical array of detectors of high vertical resolution.—Author's abstract

05728 **Perry, Eugene C., Jr.** The oxygen isotope chemistry of ancient cherts: Earth and Planetary Sci. Letters, v. 3, no. 1, p. 62–66, illus., table, 1967.

Oxygen, extracted by the BrF_5 technique from several cherts ranging from Precambrian to Upper Cretaceous in age, is analyzed for isotope ratios. A graph of $\delta(^{18}O)$ vs. SMOW plotted against time shows a constant decrease with time. The data may represent a constant change in the oxygen composition of the ocean through time. Calculating that a steady state was achieved 3×10^9 years ago, the present ocean has evolved in a simple, direct way from the primitive ocean.—HRC

05582 **Peterson, David Holmen.** Fatty acid composition of certain shallow-water marine sediments [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1997B–1998B, 1967.

05941 **Phleger, Fred B.** Some problems in marine geology, Gulf of Mexico, *in* Symposium on the geological history of the Gulf of Mexico, Antillean–Caribbean region: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 173–178, illus., 1967.

Problems in the transport of detritus are: the possible by-passing of the coastal shelf, and the lack of modern cycle detrital sediments on much of the outer continental shelf; the rate of supply of organic sediments depends upon the production, so that high organic production near river mouths and in hypersaline lagoons, the rate of supply of organogenic calcium carbonate from plankton, and rate of solution deserve attention. An understanding of marine processes which affect the characteristics and distribution of sediments will require observations and analyses by new techniques.—*from* Author's abstract

05458 **Pia, Maurice X.** Computerized volume determinations from aerial surveys, *in* Anatomy of the western phosphate field—Intermountain Assoc. Geologists, 15th Ann. Field Conf. 1967: Salt Lake City, Utah, Intermountain Assoc. Geologists, p. 215–221, illus., 1967.

Development of cross sections and the volumes method, the present procedure for terrain data recording, and data processing output are discussed.—KAS

05710 **Pincus, Howard J.** Sensitivity of optical data processing for detecting differences in fabrics [abs.]: Mining Eng., v. 19, no. 12, p. 27, 1967.

00113 **Pipiringos, George N.** Correlation and nomenclature of some Triassic and Jurassic rocks in south-central Wyoming: U.S. Geol. Survey Prof. Paper 594-D, p. D1–D26, illus., table, 1968.

Correlation and nomenclature of some Triassic and Jurassic rocks in south-central Wyoming are revised. The Chugwater is raised to group rank, and the Red Peak, Alcova, Jelm, Crow Mountain, and Popo Agie are designated as formations in it. The name Jelm Formation is used in southeastern Wyoming but in the Wind River Basin, Crow Mountain Sandstone is the name applied to rocks equivalent to the Jelm. The lower part of the Nugget Sandstone is designated the Bell Springs Member. Rocks of the Sundance Formation between the Lak and Redwater Shale Members are designated the Pine Butte Member. Rocks of marine origin, previously included in the base of the Morrison Formation in south-central Wyoming, are designated the Windy Hill Sandstone Member of the Sundance Formation.—GNP

Pistorius, Carl W. F. T. *See* Rapoport, Eliezer. 05968

05583 **Pitman, Walter Clarkson, 3d.** Magnetic anomalies in the Pacific and ocean floor spreading [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1998B, 1967.

Piwinskii, A. J. *See* Boettcher, A. L. 05695

05683 **Plaster, Roger W.; Ern, Ernest H.** Composition and profile development of three Virginia soils [abs.]: Virginia Jour. Sci., v. 18, no. 4, p. 188, 1967.

05850 **Postma, H.** Marine pollution and sedimentology, *in* Pollution and marine ecology—Conf., Galveston, Tex., 1966, Proc.: New York, Interscience Publishers, p. 225–234, illus., 1967.

Marine sedimentological and geochemical information may help determine behavior of wastes in the sea, and certain forms of suspended waste may be tracers in sediment transport study; a major point is the rate of dispersion by currents and turbulent diffusion. Dissolved materials have received considerable attention; the behavior of suspended pollutants, complicated by nearshore accumulation, may be predictable if values of their velocities of settling, deposition and scour can be compared with those of local natural sediments. Transport mechanisms for beach type, estuarine, and tidal flat accumulations are outlined. In the cycle of organic matter in the sea, dissolved waste products may be absorbed by suspended matter such as clay minerals, and liberated with sudden environmental change.—GDC

05844 **Potter, Loren D.** Differential pollen accumulation in water-tank sediments and adjacent soils: Ecology, v. 48, no. 6, p. 1041–1043, illus., tables, 1967.

Significant differences were found in pollen composition of sediments at different compass directions within large water-storage tanks [San Augustin Plains, Catron County, N. Mex.]. The center and north side were closest to the mean for the entire tank. Tank sediments showed an over-representation of arboreal pollen when compared with surface soil samples adjacent to the tank. The lower percentage of nonarboreal pollen in tanks was due to a lower percentage of Chenopodiaceae, *Amaranthus*, and Gramineae pollen. Miscellaneous arboreal taxa were present in tank sediments but not in soil samples.—Author's abstract

05645 **Pough, Frederick H.** The story of gems and semiprecious stones: Irvington-on-Hudson, N. Y., Harvey House Inc. Publishers, 142 p., illus., table, 1967.

Two short chapters tell that minerals can be both natural and synthetic, and may be recognized by hardness and crystal form as well as by color. The third chapter considers the formation of minerals in igneous and metamorphic rocks; and the fourth discusses methods of shaping and finishing. The next 12 chapters are devoted to descriptions, localities, and mineralogy of various gems, including pearls, coral, and amber, and the last chapter to imitation and synthetic gemstones. Characteristics of gemstones are tabulated; a glossary completes the book.—ESL

00036 **Powell, H. E.; Ballard, L. N.** Magnetic susceptibility of 34 manganese-bearing minerals: U.S. Bur. Mines Inf. Circ. 8359, 10 p., illus., tables, 1968.

Specific magnetic susceptibility of 34 manganese-bearing minerals including those presently commercially important, those of possible future commerical significance, and some high purity synthetic minerals were measured. Samples of isomorphous series having a wide range of composition are included. Results are tabulated.—CSB

00037 **Powell, H. E.; Ballard, L. N.** Magnetic susceptibility of group IVB, VB, and VIB metal-bearing minerals: U.S. Bur. Mines Inf. Circ. 8360, 9 p., tables, 1968.

The determined magnetic susceptibilities of 57 minerals containing titanium, zirconium, vanadium, columbium, tantalum, chromium, molybdenum, and tungsten are tabulated. The minerals include those now commercially important and some of possible future significance.—APB

Preston, Floyd W. *See* Esler, James E. 05638

05791 **Price, A. T.** Magnetic variations and telluric currents, Chap. 7 *in* The Earth's mantle (T. F. Gaskell, editor): London and New York, Academic Press, p. 125–170, illus., tables, 1967.

The Earth's main field is altered continuously by secular variations from within and transient variations of external origin. There seem to be no important magnetic sources between the Curie point isotherm near the base of the crust and some very deep level inside the Earth. Distribution of conductivity in the upper mantle can be inferred by comparing variation fields with mathematical models based on the theory of electromagnetic induction. Calculations are complicated by differential conductivity of oceanic and continental crust and shielding of the mantle by oceans from external field variations. Secular variation may be caused by time-dependent electric currents flowing in an upper layer of the liquid core, which is in motion relative to the mantle. Perturbations in the core-mantle coupling may account in part for irregular changes in length of day.—JPF

Price, Don. *See* Baker, C. H., Jr. 05808

05911 **Price, W. Armstrong.** Development of the basin-in-basin honeycomb of Florida Bay and the northeastern Cuban lagoon, *in* Symposium on the geological history of the Gulf of Mexico, Antillean-Caribbean region: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 368–399, illus., tables, 1967.

This lagoon, bimodially windy, subtropical, and a honeycomb of closely spaced, interconnecting, oval, pan-shaped basins, individually upwards of 10 miles long and 12 feet deep, lies between the mangrove swamps on the Everglades shore and the offshore islands. The basin walls, up to 2.5 feet above sea level, are Holocene marl made stable by the alternations of mangrove swamp bands and marine grasses which are in the lagoon; the bottoms are of marl or mud-covered marl. No process of accumulation adequate by itself to form such honeycombs is known. The genetic process was the drowning and embayment of oriented lakes formed in drowned marsh rills.—*from* Author's abstract

05927 **Puri, H. S.; Collier, Albert.** Role of micro-organisms in formation of limestones, *in* Symposium on the geological history of the Gulf of Mexico, Antillean-Caribbean region: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 355–367, illus., tables, 1967.

Aragonite forms the cement of modern oolites, coral reefs, calcarenites, calcilutites, and beach rock. Actinomycetes probably do the cementing. Florida and Puerto Rico beach rocks form in high-energy areas with much nutrient. The Florida beach rock is all along the coast, but the Puerto Rico beach rock is confined to the northern, current-fed shore. The aragonite is probably biogenetic, with partial or redeposition. Some of the $CaCO_3$ is removed in solution during the alteration, and a highly-porous rock can result from the intergranular microporosity.—*from* Authors' abstract

05959 **Pye, E. G.** (editor). Summary of field work, 1967, by the Geological Branch: Ontario Dept. Mines Misc. Paper 11, 73 p., illus., 1967.

In 1967 the Geological Branch of the Ontario Department of Mines undertook 26 projects, most of which were under the direction of field geologists of the Surveys Section. The locations of investigations, shown on a map of the Province, are mostly in the southern part, with three in the Patricia portion of Kenora. Results are summarized in brief reports prepared by the project leaders, with emphasis on economic aspects. Colored maps and final detailed reports are being prepared, and interim preliminary maps are being released.—GDC

05647 **Quebec Dept. of Natural Resources.** (Geological Services). Field work in 1966—Summary of results: Quebec, Quebec Dept. Nat. Resources, 44 p., illus., 1967.

This report gives summaries of the results of the 49 geologic and related projects undertaken in 1966. The accompanying map shows the location of each of the 27 parties that carried out mapping or field studies in specific areas, and marginal notes indicate the nature of another 22 diverse projects not confined to any one locality.—ESL

05942 **Rainwater, E. H.** Resume of Jurassic to Recent sedimentation history of the Gulf of Mexico Basin, *in* Symposium on the geological history of the Gulf of Mexico, Antillean-Caribbean region: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 179–210, illus., 1967.

Triassic rocks lie in grabens in Precambrian and Paleozoic rocks, Jurassic salt occurs in narrow grabens, and later Jurassic sediments cover the basins; Cretaceous carbonates overlie these even more extensively. The ancient Gulf became more restricted toward the end of the Cretaceous. The Laramide uplifted much of North America and sediments began to fill the basin from the north in Tertiary pulses. Sedimentation exceeded subsidence, and the shoreline moved outward. Pleistocene eustatic sea-level rise flooded the shelf. Sedimentation continues today. Numerous maps show the major aspects.—*from* Author's abstract

05867 **Raitt, Helen; Moulton, Beatrice.** Scripps Institution of Oceanography—First fifty years: [Los Angeles, Calif.] Ward Ritchie Press, 217 p., illus., 1967.

In 1892, W. E. Ritter and a small group of students set up a tent laboratory at Pacific Grove, Calif., to begin a biological survey of the Pacific Ocean along the coast. Their struggles to establish a foothold and gather together the men needed is told. E. W. Scripps and his sisters became interested, and were the main support.

It was moved to a new site in 1907, in 1912 became a department of the University, and was named the Scripps Institution of Biological Research. T. W. Vaughan became director in 1923, and the emphasis shifted from biology to oceanography; the name was changed to the present one in 1925. Under H. U. Sverdrup, appointed director in 1936, work from boats increased, and included sediment studies and bottom topography. In 1948, Carl Eckart became director, and in 1951, the present director Roger Revelle took office. An epilogue gives the story of the Institution as it is today.—ESL

05924 **Ramseier, René O.** Self-diffusion in ice monocrystals: U.S. Army Materiel Command Cold Regions Research and Eng. Lab. Research Rept. 232, 40 p., illus., tables, 1967.

The self-diffusion of tritium, parallel and perpendicular to the optical axis of natural and artificial ice monocrystals, was studied between -2.5 and -35.9°C. The artificial crystals were grown using a zone-melting technique. Activated samples were stored for several weeks, then sectioned and analyzed in a liquid scintillation counter to obtain the self-diffusion coefficients, which were found to be identical for both types of ice. A slight anisotropy was found due to geometry of the crystal; but activation energy was 0.62 eV for all cases. It is concluded that the diffusion takes place by a vacancy mechanism and that entire H_2O molecules are diffusing, i. e., molecular diffusion occurs. Theoretical calculations using the atomic diffusion theory and Zener's theory for D_0 are in excellent agreement with experimental results.—*from* Author's abstract

00034 **Rana, M. H.; Bullock, W. D.** Development of a petrofabric-photoelastic technique in rock mechanics: Canadian Mining and Metall. Bull., v. 61, no. 669, p. 89-92, 1968.

Combined petrofabric-photoelastic analysis will resolve the problem of correlation between present state of stress and the configuration at the time of inducement of the rock-fabric discontinuities.—ARK

05968 **Rapoport, Eliezer; Pistorius, Carl W. F. T.** Orthorhombic-disordered rhombohedral transition in $SrCO_3$ and $BaCO_3$ to 40 kilobars: Jour. Geophys. Research, v. 72, no. 24, p. 6353-6357, illus., 1967.

The aragonite/disordered rhombohedral polymorphic transition temperatures of $SrCO_3$ and $BaCO_3$ were measured to pressures near 40 kb by means of differential thermal analysis in a piston-cylinder device. The transition temperatures can be expressed as $t(°C) = 930 + 9.10P + 0.0081P^2 - 0.00135P^3$ for $SrCO_3$ and $t(°C) = 799 + 7.15P - 0.052P^2$ for $BaCO_3$, where P is the pressure in kilobars. No new phases were encountered. The initial slopes of the transition lines are in excellent agreement with the initial slopes calculated from the literature values of latent heat and volume change.—Authors' abstract

05594 **Rebull, Peter Mario.** Mechanical model analysis of clay behavior [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1925B, 1967.

05562 **Reeburgh, William Scott.** Measurements of gases in sediments [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 2158B, 1967.

00033 **Reichert, Stanley O.** Some geological aspects of radioactivity waste management [abs.]: Mining Eng., v. 20, no. 1, p. 93, 1968.

05886 **Reiher, Barbara S.; Huzzen, Carl S.** Some comments on the effective sample size of second order Markov processes [with French abs.]: Internat. Assoc. Sci. Hydrology Bull., v. 12, no. 4, p. 63-74, illus., tables, 1967.

In this paper the effective sample size of the second order Markov process is derived for N dependent events. It is shown that for all negative values of the lag-two autocorrelation p_2 less than -0.1, the N dependent events which follow a second order process yield more information than N random events.—Authors' abstract

05469 **Richards, R. W.; Bridges, J. H.** Sulphur deposits near Soda Springs, Idaho, *in* Anatomy of the western phosphate field—Intermountain Assoc. Geologists, 15th Ann. Field Conf. 1967: Salt Lake City, Utah, Intermountain Assoc. Geologists, p. 211–213, reprinted 1967; originally published 1911.

A group of sulfur springs and associated deposits of native sulfur in Bannock County, Idaho, are located along a northwest–southeast fault zone with rocks of early Carboniferous age to the east and Triassic to the west; sulfur occurs as the cement of a fault agglomerate or breccia. The deposition of sulfur is apparently due to the imperfect oxidation of hydrogen sulfide. The proximity of these deposits to volcanic centers suggests a volcanic origin for the hydrogen sulfide and associated carbon dioxide. Attempts to work the deposits have failed because of competition of high-grade deposits in Wyoming and Utah.—KAS

00075 **Richardson, Donald; Bingham, J. W.; Madison, R. J.** Water resources of King County, Washington: U.S. Geol. Survey Water-Supply Paper 1852, 74 p., illus., tables, geol. map, 1968.

King County includes parts of two physiographic features: the western, Puget Sound Lowland, and the eastern, Cascade Range. There is a marked contrast between the two in terrain, weather, and natural resources, including water. Most of the streamflow is in the Green–Duwamish, Lake Washington, and Snoqualmie basins, which have periods of flooding in winter. Most recoverable ground water in the county occurs in the Puget Sound Lowlands, in unconsolidated deposits left by continental glaciers of the Pleistocene Epoch. Bedrock, most of it in the Cascade Range, contains very little water; numerous springs are largely undeveloped. Except for excessive iron the ground water is of good quality; the most serious problem, threat of pollution, is being reduced in metropolitan Seattle. A section by R. C. Williams is cited separately.—GDC

Richardson, Eugene S., Jr. *See* Johnson, Ralph Gordon. 00087

Ridgeway, Julius M. *See* Oxley, Marvin L. 05829

05684 **Riesmeyer, W. Duncan.** Bastnaesite after allanite in the Rutherford pegmatite, Amelia County, Virginia [abs.]: Virginia Jour. Sci., v. 18, no. 4, p. 188, 1967.

05584 **Riggs, Stanley Robert.** Phosphorite stratigraphy, sedimentation, and petrology of the Noralyn mine, central Florida phosphate district [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1998B–1999B, 1967.

Ringwood, A. E. *See* Green, D. H. 05701

Ringwood, A. E. *See* Clark, Sydney P., Jr. 05772

Rippere, Kenneth H. *See* Halstead, Perry N. 00046

00097 **Ritchie, Arthur S.** Natural chromatography—A factor in petroleum migration [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 52, no. 1, p. 197, 1968.

05934 **Rives, John S.** Structural and stratigraphic traps related to extrusive rocks in south central Texas [abs.]: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 148, 1967.

Robeck, Gordon G. *See* Bendixen, Thomas W. 00092

05807 **Robertson, Forbes; Laird, Wilson M.** Historical geology—Manual of laboratory exercises (2d edition): Minneapolis, Minn., Burgess Publishing Co., 236 p., illus., tables, revised 1967; originally published 1962.

In this enlarged manual, for college students with a background in physical geology, there are two groups of exercises. In one group, dealing with geologic maps and related data, a new exercise employing the concept of unconformity-bound sequences (Wheeler and Sloss) is added for a better understanding of regional relationships. The second group deals with fossils. The map exercises have been

completely rewritten for a new selection of illustrative maps (nine in color). Two new introductory sections include principles of interpretive historical geology and a summary of sedimentary rock classification.—GDC

Robertson, W. A. *See* Roy, J. L. 00079

Robinson, Arthur H. *See* Trewartha, Glenn T. 05614

Robinson, G. B., Jr. *See* Bjorklund, L. J. 00073

00052 **Robison, Richard A.; Palmer, Allison R.** Revision of Cambrian stratigraphy, Silver Island Mountains, Utah: Am. Assoc. Petroleum Geologists Bull., v. 52, no. 1, p. 167–171, illus., 1968.

On the basis of new fossil collections, there appears to be few, if any, exposed rocks of Middle Cambrian age in the Silver Island Mountains of Utah, and rocks of Dresbachian age are at least 2,400 feet thick. New correlations and nomenclature are presented.—WCC

05931 **Rochon, R. W.** Relationship of mineral composition of shales to density: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 135–142, illus., 1967.

A relationship has been found between the bulk density of shale, electrical measurements of the induction, sonic and density curves and overpressured zones in the Miocene section of Louisiana. The phenomenon which causes high pressures is relative to periods of fast deposition when hydraulic equilibrium of interstitial waters accompanying normal compaction is disturbed by a restriction to the orderly expulsion of water from the shales. Investigations indicate changes in depositional environment cause a differential in the rate of loss of water from shale which in turn is related to overpressuring of formations.—Author's abstract

Rodgers, Elton E. *See* Chuber, Stewart. 00057

00098 **Rodgers, Elton E.; Belt, Bill B.; McGlasson, Ed. H.** Oils from Yeso reservoirs and their basinal equivalents [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 52, no. 1, p. 194, 1968; Shale Shaker, v. 18, no. 5, p. 101, 1968.

05830 **Rogers, James K.** Comparison of some Gulf Coast Mesozoic carbonate shelves: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 49–60, illus., 1967.

The Jurassic Smackover–Haynesville, the Cretaceous Sligo–Hosston, and Glen Rose–Edwards–Georgetown carbonate facies are very prominent in the Gulf Coastal Plain; similarities in depositional patterns are described. Carbonate and oolite percentages are especially useful parameters. Regionally, the patterns and the porosity were dependent upon climate and clastic supply as well as upon water depth and Louann Salt distribution. Smackover sedimentation was influenced by pre-Jurassic faulting, whereas reefs and shellbanks were important influences during the Cretaceous. The salt movement may be due to increased carbonate loading as well as fault-triggering.—*from* Author's abstract

05806 **Rose, J. N.** Fossils and rocks of eastern Iowa—A half billion years of Iowa history: Iowa Geol. Survey Educ. Ser. 1, 147 p., illus., geol. map, 1967.

The guide, designed for teachers and amateur fossil collectors, is divided into two parts. The first deals with the general history and life of the Cambrian–Mississippian periods, including collecting localities and exposures for each system. The second part comprises a series of nine field trips, arranged in stratigraphic sequence; each has at least one stop where fossils may be collected. Included are 18 plates illustrating fossils referred to in both parts, and a geologic map and columnar section for the State.—ESL

05965 **Rosenkrantz, Alfred.** Runestenen fra Kingigtorssuaq i geologisk belysning [with English summ.]: Grønland 1967, no. 11, p. 349–362, illus., 1967.

As an example of the interrelation between archaeology and geology, the runic stone from Kingigtorssuaq is the northernmost piece of evidence of the advance of the Norsemen in the 13th and 14th centuries up the west coast of Greenland. The stone consists of phyllite, a rock type not previously known to occur in the Upernavik area. In a reconnaissance mapping by the Geological Survey of Greenland in 1950, remains of a morainic cover were seen on the island which consists of gneiss. Among the erratic blocks several pieces of phyllite exactly the same as the runic stone were found, which were brought by inland ice along a route now marked by Upernaviks Isfjord. They prove the existence of an ice covered phyllite area which must be a continuation of a long known area north of Umanak, and a link with another around Kraulshavn.—*from* Author's summary

05828 **Ross, Sylvia H.; Savage, Carl N.** Idaho earth science—Geology, fossils, climate, water, and soils: Idaho Bur. Mines and Geology Earth Sci. Ser., no. 1, 271 p., illus., tables, 1967.

Although the main purpose of this review is to provide information for earth science teachers in Idaho secondary schools, the synthesis of current geologic facts makes it of some value to professional geologists as well. Idaho contains rocks and rock materials from Precambrian through Recent and many sedimentary rocks have fossils, ranging from primitive algae to Tertiary vertebrates and plants. Precambrian structural influences are strong in the north, the Idaho batholith dominates the central part, and Paleogene and Neogene downwarping, block faulting, and extrusive volcanic rocks are important in the south. The State is well endowed with both metallic and nonmetallic minerals; mineral fuels apparently are scarce. Water resources are adequate; much water not now used is poorly distributed in space and time. Landforms and geology typical of mountain and basin areas are well represented.—*from* Authors' abstract

05842 **Roth, C. B.; Jackson, M. L.; deVilliers, J. M.; Volk, V. V.** Surface colloids on micaceous vermiculite, *in* Soil chemistry and fertility—Internat. Soc. Soil Sci., Mtg., Comm. II and IV, Aberdeen, 1966, Trans.: Aberdeen, Scotland, University Press, p. 217–221, illus., 1967.

Electron micrographs of surface features of vermiculite–mica particles active in cation exchange in soils show extensive smooth cleavage areas, on some of which were scattered convoluted gel-like colloids and scrolled layers. The convoluted features on the micaceous vermiculite cleavages were strikingly similar to those found on surfaces of silica, alumina, and hydrous ferric gels, but a boiling treatment made little or no change in the gels; they are primarily free iron-oxide coatings. The surface morphology of fresh vermiculite cleavages was not as smooth as that of freshly cleaved biotite. Colorado vermiculite treated with HCl at room temperature produced siliceous relics with surface features similar to untreated vermiculite, but the relics were amorphous to X-rays.—GDC

Roth, Peter H. *See* Hay, William W. 05923

05575 **Rouse, G. E.** Palynology of Upper Cretaceous and Tertiary horizons in coastal and interior British Columbia [abs.]: Rev. Palaeobotany and Palynology, v. 2, nos. 1–4, p. 11, 1967.

00079 **Roy, J. L.; Robertson, W. A.; Park, J. K.** Stability of the magnetization of the Hurley Creek formation: Jour. Geophys. Research, v. 73, no. 2, p. 697–702, illus., tables, 1968.

Oriented samples were taken from five sites in the Hurley Creek formation of New Brunswick. This formation lies immediately over the Minto formation, which is well-dated by fossils. Thermal cleaning shows that only one very stable magnetization is present. The between-site dispersion is consistent with a magnetization acquired during or shortly after deposition. The mean directions ($D = 171°E$ and $I = +90°$) of the Hurley Creek formation are therefore considered representative of the Pennsylvanian field of New Brunswick, Canada. The corresponding pole position is 30° N., 125° E.—Authors' abstract

Rozendal, R. A. *See* Dolloff, J. H. 05899

05658 **Ruddiman, William F.; Heezen, Bruce C.** Differential solution of planktonic Foraminifera: Deep-Sea Research, v. 14, no. 6, p. 801–808, illus., 1967.

Variations of foraminiferal abundance in sediments deposited in shallow oceanic depths may give relatively accurate indications of the surface ecology at the time of deposition. In deeper realms such variations are largely a product of differential solution among the species. This leads to preferential enrichment of resistant, deep-dwelling species and to selective elimination of fragile, surface-inhabiting individuals. The shallowest depth at which differential solution is effective in equatorial Atlantic sediments is at present 4,000 m. Most faunal assemblages in depths greater than 4,500 m are differentially dissolved, and in depths greater than 5,000 m all show severe effects.—*from* Authors' abstract

05629 **Runcorn, S. K.** (editor). International dictionary of geophysics—Seismology, geomagnetism, aeronomy, oceanography, geodesy, gravity, marine geophysics, meteorology, the earth as a planet and its evolution: Oxford, England, Pergamon Press, 1728 p., illus., 1967.

In addition to Runcorn, the general editor, Edward Bullard, K. E. Bullen, W. A. Heiskanen, Harold Jeffreys, H. Mosby, T. Nagata, M. Nicolet, K. R. Ramanathan, H. C. Urey, and F. A. Vening Meinesz have contributed to the editing of this two-volume dictionary whose purpose is to supply geologists, physicists, and mathematicians, as well as those in other branches of science and in engineering, with "clear explanations of geophysical terms and arguments."—GSA Bib. Staff

05798 **Runcorn, S. K.** Wandering continents, Chap. 15 *in* The Earth's mantle (T. F. Gaskell, editor): London and New York, Academic Press, p. 475–492, illus., 1967.

Continental drift is the most important fact in understanding the Earth's mantle. Models of a dynamic mantle that take continental drift into account are essential for a meaningful analysis of world distribution of heat flow, mechanism of mountain building, and many geophysical phenomena that depart from an exactly spherically symmetrical distribution. Spherical harmonic analysis suggests that compressional and tensional features in the crust do not have separate origins. It remains to determine the present distribution of convection currents in the mantle and to infer how this has changed through time.—JPF

05869 **Rushton, A. W. A.** The Upper Cambrian trilobite *Irvingella nuneatonensis* (Sharman): Palaeontology, v. 10, no. 3, p. 339–348, illus., tables, 1967.

Irvingella nuneatonensis (Sharman, 1886), of which the complete dorsal exoskeleton is known, is redescribed, illustrated for the first time, and distinguished from other species. The ventral cephalic sutures and rostrum are like those of *Dunderbergia* (Family Elviniidae). Three abnormally developed individuals are described. *Irvingella nuneatonensis* comes from the upper part of the Zone of *Olenus* (above the base of the Subzone of *Olenus dentalis*) and its horizon is not below the upper part of the *Elvina* Zone of the Upper Cambrian sequence in the U.S.A.—Author's abstract

Ryall, Alan. *See* Stauder, William. 05902

05619 **Sahinen, U. M.; Johns, W. M.; Lawson, D. C.** Geochemical investigations in Lincoln and Flathead Counties, Montana: Montana Bur. Mines and Geology Bull. 61, 18 p., illus., 1967.

Soil samples (3,135) were collected at 1/8-mile intervals in the Swamp Creek area of the Cabinet Mountains and in the Sheppard Creek area of the Salish Mountains, and stream-sediment samples (634) were collected at 1/2-mile intervals in the upper Wolf Creek drainage and along the western front of the Whitefish Mountains. The total area covered was 429 square miles. All samples were analyzed for copper, lead, and zinc by the pyrosulfate-fusion method. Additional investigation is recommended for 12 specific localities in the areas sampled.—*from* Authors' abstract

Sakthivadivel, R. *See* Ackermann, Norbert L. 00107

05873 **Sanchez Morales, Virgilio.** Estudio geológico de la porción sur del área interarrecifal del Atolón de la Faja de Oro: Geología y Metalurgia, v. 3, no. 21, p. 5–56, illus., 1967.

This work is based on observations and study of channel samples and deep drill cores, which were collected in the inner reefs of the Faja de Oro, south of Tuxpan, Veracruz, on the Gulf coast of Mexico, and on existing geological information of the exposed field, and how the data fits seismological prospects in the area. A stratigraphic table correlates the Jurassic to Tertiary formations briefly described in the text, including characteristic fossils. From the structural sections and alinements, petroleum possibilities are indicated in the Abra Formation of Cretaceous age.—GDC

05862 **Sandberg, Charles A.** Measured sections of Devonian rocks in northern Wyoming: Wyoming Geol. Survey Bull. 52, 93 p., illus., 1967.

As part of a regional stratigraphic study of the Williston Basin and northern Rocky Mountain area, 13 measured surface sections and two well cores, which provide data for other reports on Devonian and lowermost Mississippian rocks, are described in detail, including their regional correlation and the brecciation of the carbonate rocks. Twelve sections are in the Bighorn and Beartooth Mountains and Absaroka Range of northern Wyoming. The Interlake Formation of Silurian and latest Ordovician age is recognized and described for the first time in this region; it is present in the cores of two wells in the northern Powder River basin, near the Wyoming–Montana state line.—GDC

Sandoval, F. M. *See* Benz, L. C. 00141

05711 **Sargis, Sam G.** Savings through geophysics—Case histories [abs.]: Mining Eng., v. 19, no. 12, p. 30, 1967.

05455 **Sassen, Roger.** Crystals and Liesegang structures in silica gel: Jour. Geol. Education, v. 15, no. 5, p. 198–199, 1967.

Experimenting with mineral-forming substances can yield products similar to natural occurrences, thereby giving clues as to conditions that may have existed in nature. Precipitates in gel media often exhibit a peculiar phenomenon described by Liesegang (1913). Rings and bands of agate have been attributed to such phenomena operating in silica gels that were later altered to microcrystalline quartz, an interpretation more recently not considered valid. The contention that concentric structures of limonite in weathering rocks are due to these phenomena working in a colloidal matrix or intergranular film has been supported. Procedures for producing crystals and Liesegang structures are described, with variations; of particular interest are dendritic crystals of copper. For classroom demonstration dendritic crystals of metallic lead are excellent.—GDC

Saunders, Burnett W. *See* Yochelson, Ellis L. 05854

Savage, Carl N. *See* Ross, Sylvia H. 05828

00099 **Sax, N. A.; Stenzel, William K.** Oils from Abo reservoirs of northwestern shelf [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 52, no. 1, p. 195, 1968; Shale Shaker, v. 18, no. 5, p. 101–102, 1968.

05712 **Sayers, R. W.; Tippett, M. C.; Fields, E. D.** The ore deposits at Copper Canyon and Copper Basin, Lander Co., Nevada [abs.]: Mining Eng., v. 19, no. 12, p. 33, 1967.

Scarbrough, W. L. *See* Joiner, T. J. 00040

05624 **Schafer, C. T.** Factors influencing the numerical accuracy of benthonic Foraminifera population counts from bottom sediment samples, Gulf of St. Lawrence: Maritime Sediments, v. 3, nos. 2–3, p. 71, 1967.

Surface sediment samples may be changed by several factors connected with use of mechanical samplers. Also, feeding habits and locomotive modes of certain species, and changes in hydrodynamic conditions may cause redistribution of populations. Analysis of data suggests that benthonic foraminiferal populations are characterized by a patch-like distribution that cannot be assessed from a single sample.—ESL

00045 **Scharon, LeRoy.** Geophysics to benefit from space technology, *in* What should be the long-range R and D mission for the mineral industries?: Mining Eng., v. 20, no. 1, p. 56–57, 1968.

Space exploration research is not only introducing new techniques but also providing the concept of miniaturization which by 1980 will probably create an entirely new generation of geophysical instrumentation for the space environment as well as for the surface, subsurface, and underwater environments. Most important, the direct rather than the indirect approach to mineral exploration will be the normal rather than the exception as it is now. Completely automated and computer-oriented systems will transform raw data into finished maps ready for interpretation.—FCC

00155 **Scheidegger, A. E.** Horton's law of stream order number and a temperature-analog in river nets: Water Resources Research, v. 4, no. 1, p. 167–171, 1968.

Statements of Horton's law in Horton [1945], Strahler [1957], and consistent stream ordering systems are presented. A topological characterization of a 'Horton net' is given. It is then shown how the analog of 'temperature' can be defined in microcanonical ensembles of stream nets, based on an earlier representation of river nets by graphs (bifurcating arborescences).—Author's abstract

05834 **Scheidegger, A. E.** A complete thermodynamic analogy for landscape evolution: Internat. Assoc. Sci. Hydrology Bull., v. 12, no. 4, p. 57–62, illus., 1967.

The analogy [postulated by Leopold and Langbein, 1962] embodying an entropy concept for landscape evolution can be extended to all other thermodynamic functions.—Author's abstract

Scheidegger, A. E. *See* Sturgul, J. R. 05866

05972 **Scheidegger, Adrian Eugen; O'Keefe, J. A.** On the possibility of the origination of geosynclines by deposition: Jour. Geophys. Research, v. 72, no. 24, p. 6275–6278, illus., 1967.

This paper maintains the thesis that mechanisms are possible whereby (ortho) geosynclines are caused by the deposition of sediments in shallow water. This can be done in conformity with the principle of isostasy, notwithstanding arguments to the contrary that have been advanced heretofore. One particular mechanism of this type is described in detail, namely, the compensation of a load on the crust by the migration of a low melting point fraction in the mantle. Since this fraction may have nearly the same density as the sediments, the well-known difficulty of the production of externally caused geosynclines is met.—Authors' abstract

00090 **Schimke, Gerald R.; Bufe, Charles G.** Geophysical description of a Pacific Ocean seamount: Jour. Geophys. Research, v. 73, no. 2, p. 559–569, illus., table, 1968.

Intensive bathymetric, magnetic, and gravity data have been obtained over the previously uncharted Chatauqua seamount, 155 km west of Kauai, Hawaii. Detailed analyses of the data show that this seamount lies on the flank of the Hawaiian Ridge and is one member of a 230-km-long chain of seamounts oriented about 30° from normal to the trend of the ridge. It rises with a slope of 15° from 4,500 m to at least 1,785 m depth. Although the upper part is normally polarized, the bulk appears to be reversely polarized, the contrast in magnetic properties extending to about 1 km beneath the sea floor. The mean density of Chautauqua seamount is 2.5 g per cc. The gravity field shows evidence of block faulting during its development. The reversed magnetization could have been acquired during the Matuyama epoch or an earlier one.—DBV

Schlee, John. *See* Gibson, Thomas G. 05656

05714 **Schmidt, Ronald G.** Economics of exploration for gas storage within underground aquifers [abs.]: Mining Eng., v. 19, no. 12, p. 27, 1967.

Schmidt, Ronald R. *See* Hay, William W. 05923

05457 **Schmitt, William O.** The Gay Mine, Fort Hall, Idaho, *in* Anatomy of the western phosphate field—Intermountain Assoc. Geologists, 15th Ann. Field Conf. 1967: Salt Lake City, Utah, Intermountain Assoc. Geologists, p. 195–202, illus., 1967.

The Gay mine phosphate deposits are located at Fort Hall in southeast Idaho. The stratigraphic section of the Meade Peak Member of the Phosphoria Formation is discussed and illustrated, geologic sections and typical pit cross sections are shown, and structural features and mining practices and procedures are discussed briefly.—KAS

05576 **Schoenwetter, J.** Methods of correlation and analysis of surface samples in semi-arid lands [abs.]: Rev. Palaeobotany and Palynology, v. 2, nos. 1–4, p. 16, 1967.

05577 **Schoenwetter, J.** Pollen chronology of the last 2,000 years in the American southwest [abs.]: Rev. Palaeobotany and Palynology, v. 2, nos. 1–4, p. 18, 1967.

05925 **Scholl, David W.; Craighead, Frank C.** Recent geologic history of the west coast of Florida; coastal mangrove swamps, and Florida Bay [abs.], *in* Symposium on the geological history of the Gulf of Mexico, Antillean–Caribbean region: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 481, 1967.

Schreiber, Edward. *See* Manghnani, Murli H. 00084

05688 **Schumann, D.** Die Lebensweise von *Mucrospirifer* Grabau, 1931 (Brachiopoda): Palaeogeography, Palaeoclimatology, Palaeoecology, v. 3, no. 3, p. 381–392, illus., 1967.

The life position and feeding currents of *Mucrospirifer reidfordi* Crickmay (Upper Devonian of Canada) are deduced from commensal *Cornulites*. The brachiopod lay on its beak, attached to dead bryozoans or corals, and opened upward. Water entered at the sides, and was ejected medially. *Cornulites* benefited by feeding on the hosts inflowing current, and disturbed marginal shell growth.—Author's summary

Schwartz, W. A. *See* Bendixen, Thomas W. 00092

05470 **Schwarze, David M.** History of the Conda operation—Underground to strip mining, *in* Anatomy of the western phosphate field—Intermountain Assoc. Geologists, 15th Ann. Field Conf. 1967: Salt Lake City, Utah, Intermountain Assoc. Geologists, p. 187–194, illus., 1967.

The Conda phosphate property, located in Caribou County, Idaho, has operated continuously for 46 years, first as an underground mine and later as an open pit. The stratigraphy and a generalized stratigraphic section of the Meade Peak Member of the Phosphoria Formation are given. History of the mine, exploration, and mining procedures are discussed briefly.—KAS

05937 **Seewald, Kenneth O.** Stratigraphy of the Upper Cretaceous Austin Group, central Texas [abs.]: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 151, 1967.

05690 **SenGupta, Barun K.** Distribution of Foraminifera in the sediments of the Grand Banks—A preliminary report: Maritime Sediments, v. 3, nos. 2–3, p. 61–63, illus., 1967.

The Grand Banks of Newfoundland support a large and diverse suite of Foraminifera. A quantitative study was done of 30 bottom grab samples from the Tail of the Bank. A list of 75 benthonic species is given, of which only 12 attain a maximum frequency of 5 percent or more in any sample. There is usually an

inverse relation between foraminiferal abundance and grain-size of the sediment. The ratio between numbers of calcareous and arenaceous individuals seems erratic. Six species of planktonic Foraminifera have been identified. The distribution is shown on sketch maps.—ESL

05477 **Service, A. L.** Evaluation of the phosphate reserves in southeastern Idaho, *in* Anatomy of the western phosphate field—Intermountain Assoc. Geologists, 15th Ann. Field Conf. 1967: Salt Lake City, Utah, Intermountain Assoc. Geologists, p. 73–95, illus., tables, 1967.

Commercially valuable phosphate deposits in Idaho occur in both the Meade Peak and Retort Members of the Phosphoria Formation; largest resources are in the Meade Peak. Ten districts of the Idaho phosphate field are described. Based on Bureau of Mines and Geological Survey data, phosphate reserves in Idaho available by surface mining methods total 1.2 billion short tons (+31 to 10 percent P_2O_5) and resources above and within 100 feet below entry total 5.99 short tons (+31–10 percent P_2O_5).—KAS

05685 **Sexton, Mary E.; Sherwood, W. Cullen.** Comparison of X-ray emission and rapid chemical analysis for selected silicate rocks [abs.]: Virginia Jour. Sci., v. 18, no. 4, p. 188, table, 1967.

05757 **Shannon, J. P., Jr.; Lord, C. W.** Preservation of unconsolidated sediment cores in plastic: Jour. Sed. Petrology, v. 37, no. 4, p. 1200–1203, illus., 1967.

This method of imbedding cores in lucite allows preservation of any textural variety of unconsolidated sediment in a permanent, durable mount. It does not depend on penetration of the specimen by the preserving fluid.—*from* Authors' abstract

05639 **Shattles, D. E.; Callahan, J. A.; Broussard, W. L.** Water use and development in Jackson County, Mississippi, 1964–67: Mississippi Board Water Commissioners Bull. 67–3, 23 p., illus., tables, 1967.

Water used in the Pascagoula area amounts to about 68 mgd, an increase of 3 mgd since 1964. Surface-water withdrawals amount to 55 mgd and ground water, 13 mgd. Two new water systems in the area withdraw an aggregate of 1.3 mgd from the Graham Perry Formation. Runoff in the Pascagoula River basin averaged 19 in. for the study period, which equals the longtime average for the basin. Salt-water intrusion up the East Pascagoula and West Pascagoula Rivers in September 1964 was to mile 15 1/2 and mile 16, respectively. Ground-water levels are declining, and the rate of decline is greater in the Pascagoula Formation than in the Graham Ferry. In nine monitor wells in the area, there has been a slight decrease in chloride concentration since 1961.—*from* Authors' abstract

05853 **Shawe, Daniel R.; Parker, Raymond L.** Mafic-ultramafic layered intrusion at Iron Mountain, Fremont County, Colorado: U.S. Geol. Survey Bull. 1251-A, p. A1–A29, illus., tables, geol. map, 1967.

Mafic-ultramafic rocks form a small layered funnel-shaped complex, including several smaller discordant intrusions, within Precambrian metamorphic rocks at Iron Mountain, Colo.The complex consists of several gradational varieties of gabbro, pyroxenite, dunite, anorthosite, and magnetite iron ore. Brown amphibole, probably kaersutite, is a late-stage primary mineral. Part of the complex is well layered, having originated through crystal settling in mafic magma. Conspicuous structures characteristic of sedimentary rocks are graded bedding, crossbedding, and scour-and-fill. Discordant bodies of pyroxenite and anorthosite intrude the layered rocks and indicate later differentiation below or beyond the main chamber. The rocks appear to be comagmatic with alkalic rocks of the McClure Mountain Complex.—DRS

05592 **Sheikh-ol-Eslami, Bahman.** An analysis of 'clay-adsorbed' water using nuclear magnetic resonance spectroscopy [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1761B, 1967.

05456 **Sheldon, R. P.; Maughan, E. K.; Cressman, E. R.** Sedimentation of rocks of Leonard (Permian) age in Wyoming and adjacent states, *in* Anatomy of the western phosphate field—Intermountain Assoc. Geologists, 15th Ann. Field Conf. 1967: Salt Lake City, Utah, Intermountain Assoc. Geologists, p. 1–13, illus., 1967.

Studies on the genesis of the northwestern United States phosphate deposits (Permian) have been very useful in formulating an exploration hypothesis for discovery of new deposits. The facies, paleogeographic and other maps and various sedimentation data presented indicate that relations between Permian sediments formed in western Wyoming and those formed in markedly different environments in eastern Wyoming were similar to present day relations along several continental margins where cold, upwelling waters, rich in nutrients and organic matter, are areas of phosphate deposition west of arid continental regions. This great similarity seems to justify the phosphorgenic province concept used in the McKelvey–Sheldon (1963;1964) hypothesis of exploration.—KAS

Sheldon, R. P. *See* McKelvey, V. E. 05473

05478 **Sheldon, Richard P.** World tectonic distribution of economic sedimentary phosphate deposits [abs.], *in* Anatomy of the western phosphate field—Intermountain Assoc. Geologists, 15th Ann. Field Conf. 1967: Salt Lake City, Utah, Intermountain Assoc. Geologists, p. 97, 1967.

05929 **Shepard, Francis P.** Delta-front diapirs off Magdalena River, Colombia compared with hills off other large deltas, *in* Symposium on the geological history of the Gulf of Mexico, Antillean–Caribbean region: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 316–325, illus., 1967.

Exploration of the slope off the Magdalena River with reflection profiling has shown a series of large diapiric intrusions with hills rising as much as 600 feet above the sea floor. These diapirs are mostly bordered by down-bent formations in contrast to the usual, but not invariable, up bending around salt domes. Because salt domes are unknown in the entire area, and because plastic mud layers must be common in the delta-front beds, it seems likely that these are mud diapirs of possibly some type of underwater mud volcanoes. The mud lump islands off the Mississippi Delta have generally been considered rather unique. However, the finding of these diapirs suggests that such intrusions may not be unusual.—*from* Author's abstract

Sherwood, W. Cullen. *See* Sexton, Mary E. 05685

Shinn, Eugene A. *See* Ball, Mahlon M. 05746

05462 **Short, Nicholas M.** The role of planetary geoscience in the university curriculum: Jour. Geol. Education, v. 15, no. 5, p. 175–180, tables, 1967.

To bring the fruits of this summary panel discussion (Symposium on Astrogeology, University of Michigan, 1967) to the attention of the geological community and to educators faced with updating geology curricula, the more salient statements made by the participants are presented by the moderator of the panel, with concluding remarks considering aspects of the field of astrogeology or planetology to supersede or supplement the classical geology core of geosciences. University training of any student for a career in astrogeology should be on a strong base in fundamental geology, with a broader than average background in other scientific disciplines, supplemented by appropriate special courses.—GDC

Silberhorn, Gene M. *See* Taylor, Sara Sue. 05626

05777 **Sillén, Lars Gunnar.** Gibbs phase rule and marine sediments, [Chap.] 4 *in* Equilibrium concepts in natural water systems—Am. Chem. Soc., 151st Ann. Mtg., Pittsburgh, 1966, Div. Water, Air and Waste Chemistry Symposium: Washington, D.C., Am. Chem. Soc. (Adv. Chemistry Ser. 67), p. 57–69, illus., table, 1967.

An imaginary equilibrium model of the sea water+sediment+air system is constructed by adding the components successively. The working hypothesis is proposed that in an intermediate model, with the eight components H_2O–HCl–SiO_2–

$Al(OH)_3$–NaOH–KOH–MgO–CaO, seven phases would be at equilibrium: (1) an aqueous solution of composition about equal to sea water, (2) quartz, (3) kaolinite, (4) hydromica (illite), (5) chlorite, (6) montmorillonite, (7) phillipsite or some other zeolite. The composition of the solution and of each solid phase will be fixed once p, T, and Cl^- are given. Adding CO_2 brings $CaCO_3$; adding FeO and Fe_2O_3 bring glauconite and goethite. Studies of separated clay phases are highly desirable. Author's abstract

05585 **Silverman, Arnold Joel.** Investigation of the parameters controlling base metal dispersion in selected ore deposits [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 1999B–2000B, 1967.

00131 **Singh, Awtar; Mitchell, James K.** General stress–strain–time function for soils: Am. Soc. Civil Engineers Proc., v. 94, paper 5728, Jour. Soil Mechanics and Found. Div., no. SM 1, p. 21–46, illus., 1968.

The stress–strain–time behavior of soils may assume a variety of forms, depending on such factors as soil type, soil structure, stress history, drainage conditions, and type of loading. Generalizations concerning creep in soils suggested by various investigators are sometimes contradictory. However, test results show that there exist linear relationships between logarithm of strain rate and logarithm of time for a given stress and between logarithm of strain rate and stress at any given time, provided the creep stress level is between the practical limits of about 30 percent to 90 percent of the initial soil strength. These findings lead to a simple three-parameter general stress–strain–rate–time relationship. Integration of this relationship yields creep curves which are observed to agree in form with the experimental results.—Authors' abstract

Singh, Awtar. *See* Mitchell, James K. 00133

Siratovich, E. N. *See* Dolloff, J. H. 05899

05569 **Sirkin, Leslie A.** Correlation of late glacial pollen stratigraphy and environments in the northeastern United States: Rev. Palaeobotany and Palynology, v. 2, nos. 1–4, p. 205–218, illus., 1967.

The southern limit of glaciation is shown by moraines of Olean and Kent age in Pennsylvania, New York, New Jersey, and southern New England, and by drift of Kent and Port Huron age north of the margin. The herb pollen zone subzones (F, W, and V) show the tundralike vegetation, often park tundra, succeeded by tundra. Tundra is also recorded in the T-subzone of southern New England and in the L-subzone in Maine. The herb pollen zone transgresses late glacial time and represents a more restricted sequence. Spruce generally succeeds it as early as Kent time near the moraines.—*from* Author's summary

Skermer, Nigel A. *See* Hills, Sydney F. 00134

05713 **Slankis, John A.; Becker, Alex.** Telluric and magneto-telluric measurements at 8 cps [abs.]: Mining Eng., v. 19, no. 12, p. 31, 1967.

Slawson, W. F. *See* Blenkinsop, J. 05738

Sloan, R. E. *See* Hogberg, R. K. 05809

05879 **Smith, C. H.; Irvine, T. N.; Findlay, D. C.** Geology, Muskox intrusion, south sheet, District of Mackenzie: Canada Geol. Survey Map 1214A, scale 1:63,360, sections, 1967.

A table on the map sheet gives the typical mineral constitution of the map units shown in the legend; it does not include extreme variations that may occur locally in each unit.—MCM

05880 **Smith, C. H.; Irvine, T. N.; Findlay, D. C.** Geology, Muskox intrusion, north sheet, District of Mackenzie: Canada Geol. Survey Map 1213A, scale 1:63,360, sections, 1967.

The map sheet contains a table which gives the typical mineral constitution of the map units shown in the legend; it does not include extreme variations that may occur locally in each unit.—MCM

05579 **Smith, Clyde Louis.** Geology of eastern Mount Bennett Hills, Camas, Gooding, and Lincoln Counties, Idaho [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 2000B, 1967.

Smith, Harold M. *See* Holmquest, Harold J., Jr. 00106

05715 **Smith, John D.** Rock mechanics data applied to mine design [abs.]: Mining Eng., v. 19, no. 12, p. 34, 1967.

00072 **Smith, W. Calhoun.** Geology and engineering characteristics of some surface materials in McHenry County, Illinois: Illinois Geol. Survey Environmental Geology Notes, no. 19, 23 p., illus., tables, 1968.

Seventy-two samples of fresh and weathered material were collected and analyzed. Six glacial till units were identified and sampled; samples also came from sand and gravel, loessial soil, a lacustrine deposit, and the Marengo and West Chicago moraines. Engineering characteristics of identifiable geologic units are described. Data are tabulated on results of grain-size analyses and Atterberg limits, mineralogical composition by X-ray diffraction, and activity and liquidity index values.—ESL

Snetsinger, K. G. *See* Bunch, T. E. 05953

00132 **Snow, David T.** Rock fracture spacings, openings, and porosities: Am. Soc. Civil Engineers Proc., v. 94, paper 5736, Jour. Soil Mechanics and Found. Div., no. SM 1, p. 73–91, illus., table, 1968.

The amount of grout to inject into a given volume of fractured foundation rock depends on fracture porosity and on spacing and sizes of fracture openings—properties which can be calculated from water-pressure tests. The method is valid for fractured rock masses whose intergranular permeability is very small compared to fracture permeability, and if solution cavities or pervious interbeds are absent. Studies of 35 dam sites show maximum fracture porosities of about 0.05 percent near the surface, decreasing to about 0.005 percent at the 200-ft depth. Fracture openings decrease from about 100 to 50 microns in the same depth interval, and minimum spacing of open fractures increases from 4 to 14 feet. Grout penetration is limited to the largest fractures. All rock types appear to be similar in fracture properties.—*from* Author's abstract

00058 **Soderstrom, Glen S.** Stratigraphic relations in Palo Duro–Hardeman basin area [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 52, no. 1, p. 196–197, 1968; Shale Shaker, v. 18, no. 5, p. 97, 1968.

Soga, Naohiro. *See* Manghnani, Murli H. 00084

00085 **Soga, Naohiro.** Temperature and pressure derivatives of isotropic sound velocities of α-quartz: Jour. Geophys. Research, v. 73, no. 2, p. 827–829, illus., tables, 1968.

It is pointed out that for α-quartz the variation of approximate averaged shear velocity with pressure and temperature is anomalous, remaining almost unchanged with temperature and decreasing with pressure. More experimental data on solids of hexagonal and trigonal classes should be gathered before attempting to discuss the structural dependency of the phenomenon, as well as the geophysical implications.—DBV

05734 **Sparks, Dennis Michael.** Microfloral zonation and correlation of some lower Tertiary rocks in southwest Washington and some conclusions concerning the paleoecology of the flora [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 2000B, 1967.

05578 **Spink, Walter John.** Stratigraphy and structure of the Paleozoic rocks of northwestern New Jersey [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 2001B, 1967.

Spiva, Frank T., Jr. *See* Doss, A. K., Jr. 00070

00055 **Squarer, David; Herbertson, John G.** Relation between bed forms and friction in streams—Discussion [of paper 5242 by V. A. Vanoni and L.-S. Hwang, 1967]: Am. Soc. Civil Engineers Proc., v. 94, paper 5703, Jour. Hydraulics Div., no. HY 1, p. 327–331, table, 1968.

Vanoni and Hwang (ibid., v. 93, no. HY 3, p. 121–144, 1967) have carried out laboratory experiments in flumes with rippled beds to determine relation between the friction factor and geometric parameters of the ripples. Squarer suggests a better way to describe rippled bed geometry, by replacing the parameters for mean ripple height and mean ripple length (H and L) with the statistical parameters for standard deviation of bed level measured from its mean elevation and for wave length corresponding to 50 percent of the area under the spectral density curve (L_{50}). Herbertson notes considerable scatter in some figures, and gives an explanation for this, using a correlation procedure in which sediment transport parameters are converted into nonadjusted terms of dynamic velocities, imposed velocities, and other imposed flow characteristics.—VMJ

05813 **Stacey, F. D.** Electrical resistivity of the Earth's core: Earth and Planetary Sci. Letters, v. 3, no. 3, p. 204–206, 1967.

Allowance for effect of impurities in the iron of the Earth's fluid core increases its electrical resistivity by a factor of about 10 over previous estimates, to a new preferred value of 3×10^{6} emu (3×10^{-5} ohm m). Extrapolations of the resistivity of pure liquid iron to probable temperatures and pressures of the core only involve factors of 1.6 and 1.3 and are slight compared with the impurity effect. The plausible range of values is 10^{6} to 2×10^{7} emu, which could be substantially narrowed by resistivity measurements on iron–alloys in the liquid state. The new estimate strongly favours precessional torques rather than convection as the driving mechanism for the geomagnetic dynamo.—Author's abstract

05902 **Stauder, William; Ryall, Alan.** Spatial distribution and source mechanism of microearthquakes in central Nevada: Seismol. Soc. America Bull., v. 57, no. 6, p. 1317–1345, illus., tables, 1967.

In the summer of 1966 a small tripartite array at the southern extremity of the surface faulting of the 1954 Fairview Peak earthquake recorded an average of 31 earthquakes per day; a detailed study of 400 of these is reported here. Focuses were concentrated at 10–15 km depth, clustering toward the end of the 1954 surface faulting; they lie along two planar zones, the first parallel to the fault plane solution of the 1954 earthquake (strike N. 11° W., dip 62° E.) ending at the southern end of the surface fracture, and the second (strike N. 50° E., dip 50° SE.) beginning at that point and extending southwestward. The latter apparently marks the southern end of the 1954 faulting. In both zones motion is predominantly dip-slip. The complexity of the seismic signatures arises chiefly from propagation effects.—DBV

Stearns, Richard G. *See* Johnson, Robert W., Jr. 05766

Stenzel, William K. *See* Sax, N. A. 00099

00108 **Sternberg, Yaron M.** Simplified solution for variable rate pumping test: Am. Soc. Civil Engineers Proc., v. 94, paper 5737, Jour. Hydraulics Div., no. HY 1, p. 177–180, illus., table, 1968.

A simple graphical method is presented for the determination of aquifer characteristics from a variable discharge pumping test. The method presented is applicable to throttled or unthrottled pumping tests and requires only a few simple calculations. An example based on synthetic well history is presented.—Authors' abstract

05870 **Stevenson, D. L.; Whiting, L. L.** Geologic structure of the Devonian–Silurian Hunton Limestone Megagroup in Illinois: Illinois Geol. Survey Illinois Petroleum 87, 5 p., illus., 1967.

A geologic structure map, contoured on the top of the Devonian–Silurian Hunton Limestone Megagroup [where overlain by the New Albany Shale], has been drawn to a scale of 1:500,000. The map shows structural contours with 100-ft intervals, county boundaries, and township and range lines [also faults]. As future revisions are made, blue-line reproductions of the revised map will be available.—Authors' abstract

05735 **Stice, Gary Dennis.** The geology and petrology of the Manu'a Islands, American Samoa [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 2001B–2002B, 1967.

Stockman, Kenneth W. *See* Ball, Mahlon M. 05746

Stoiser, Lee R. *See* Wells, J. D. 05717

05560 **Stone, Irving Charles, Jr.** Geochemistry and mineralogy of continental shelf sediments off the South Carolina coast [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 2055B–2056B, 1967.

00042 **Strimple, Harrell L.** *Paracromyocrinus marquisi* from the Savanna Formation, Oklahoma: Oklahoma Geology Notes, v. 28, no. 1, p. 33–36, illus., 1968.

Specimens collected from the Sam Creek Member of the Savanna Formation (Desmoinesian), north of Muskogee, Wagoner County, with an undescribed form from New Mexico and the type of the genus from Nevada, suggest a Middle or Lower Pennsylvanian age for *Paracromyocrinus marquisi*. The species is based on a monotype, a crown with ten biserial arms, collected from the banks of the Llano River, Mason County, Tex.; the horizon is not known. Three specimens are illustrated and described.—ESL

00156 **Stubbs, Peter.** Ocean floor conveyor belts: Sea Frontiers, v. 14, no. 1, p. 41–49, illus., 1968.

Oceanographers are witnessing a slow creep of the Earth's crust, at rates of inches per year. Magnetic anomalies demonstrate not only past mobility of ocean floors, but also active spreading, in line with bottom features and the convection theory. Decay of radioactive elements in the mantle is the energy source. If the southern continents have traveled radially northward, and the Americas westward from Europe and Africa, the crumpled Cordilleran and Alpine–Himalayan belts may be part of that process. Mid-ocean ridges are built of unfolded lavas and active volcanoes. That convection currents rose along them and, like monster conveyor belts, bore the crust apart, is a bold suggestion rounding out the drift hypothesis. The magnetic maps are symmetrically striped parallel to the ocean ridges, with tear-fault offsets indicating spreading at different rates.—GDC

Stumm, Werner. *See* Morris, J. Carrell. 05783

00140 **Sturges, David L.; Sundin, Robert E.** Gross alpha and beta radiation in waters at a Wyoming mountain bog: Water Resources Research, v. 4, no. 1, p. 159–162, illus., table, 1968.

Waters collected between July and October 1965 from four locations at a mountain bog were analyzed for radiologic content. The gross alpha and beta content was less than 5 and 10 pc/liter, respectively. Gross beta activity of filterable solids in ground water above the bog reached 400 pc/gram when the water table was at a minimum, but at other times and places the gross beta activity of filterable solids was less than 100 pc/gram. Radiation levels in waters from snow, overland flow, and stream sources were measured in May, June, or October 1965. Snow water activity was less than 25 pc/liter, but filterable solids had a maximum gross alpha and beta activity of 243 and 1,348 pc/gram, respectively. Vegetation and litter on

the bog surface screened radionuclides from snow melt water.—*from* Authors' abstract

05866 **Sturgul, J. R.; Scheidegger, A. E.** Tectonic stresses in the vicinity of a wall: Felsmechanik u. Ingenieurgeologie, v. 5, nos. 2–3, p. 137–149, illus., 1967.

The problem of the modification of a homogeneous tectonic stress field due to the presence of a rock wall is considered. Numerical calculations of the stress values in the vicinity of such a wall are presented. The effect of body forces (the weight of the rock) may simply be added, since elastostatics is a linear theory and, thus, the principle of superposition holds. The solution has applications in geomorphology and engineering.—KAS

Sundin, Robert E. *See* Sturges, David L. 00140

Sutherland, Alex J. *See* Bonham-Carter, G. F. 05930

05969 **Sutherland, Alex J.** Proposed mechanism for sediment entrainment by turbulent flows: Jour. Geophys. Research, v. 72, no. 24, p. 6183–6194, illus., 1967.

The means by which turbulent flows entrain sediment grains from alluvial stream beds were studied. Entrainment was considered to include both the initiation of sediment motion and the suspension of grains by the flow. Observations of grain motion induced by turbulent flows and by a pulsating jet led to the formulation of an entrainment hypothesis based on the concept of turbulent eddies disrupting the viscous sublayer and impinging directly onto the grain surface. It is suggested that grain entrainment results from the interaction between fluid elements within an eddy and the sediment grains. Experiments made in a laboratory flume with turbulent flows over sediment beds of different form are described. The resultant grain motion and the observed effects of sediment and fluid interaction are explained, in each case, in terms of the entrainment hypothesis.—Author's abstract

Sutton, Robert G. *See* Walker, Roger G. 05748

Swain, F. M. *See* Dolloff, J. H. 05899

Swain, Frederick M. *See* Engel, Paul L. 05926

00094 **Swanson, Donald C.** Geologic development of Anadarko basin and its deposits of hydrocarbons [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 52, no. 1, p. 198, 1968; Shale Shaker, v. 18, no. 5, p. 97, 1968.

Swanson, R. W. *See* McKelvey, V. E. 05473

05549 **Swanson, Roger W.** Geology of the western phosphate field, *in* Industrial seminar, western phosphate region, 1966, Proc.: Montana Bur. Mines and Geology Spec. Pub. 42, p. 32–38, illus., 1967.

The western phosphate field encompasses 150,000 sq mi in Idaho, Wyoming, and Utah. The stratigraphic details of the Permian in the area are reviewed. The Meade Peak Member of the Phosphoria Formation contains the phosphate; it is one of several intertongued chert, shale, and carbonate facies, each of which is discussed as the result of an environment of deposition. The phosphate was deposited in a basin, almost entirely enclosed, surrounded by lowlands providing little detritus; cold, phosphate-rich ocean water welled upward. The phosphorite was deposited by these waters in water 200 to 1,000 m deep as the pH increased with the decrease in temperature and CO_2. The tectonic history is summarized; no new details are included.—HRC

05692 **Swift, Donald J. P.; Lyall, Anil K.** Bay of Fundy—Reconnaissance by sub-bottom profiler: Maritime Sediments, v. 3, nos. 2–3, p. 67–70, illus., 1967.

Profiles show the bay is floored by gently dipping Triassic sedimentary rocks; a submarine basalt cuesta extends from seacliffs at the mouth of Minas Basin towards the center of the bay. Carboniferous rocks dip steeply along the north side of Minas

Basin. The Fundy syncline, the dominate structure, is bounded on the northwest by a zone of normal faults. The bay is the result of glacial erosion, and the floor is smooth with glacial striations. Some channels have been incised by subglacial streams. Most surficial deposits appear to be relict from the Pleistocene, but sand bodies occur along the southwestern shore due to stronger currents caused by the Coriolis effect. On the northeast side, drift is overlain by Holocene mud. Two profiles and three cross sections are included.—ESL

Syono, Y. *See* Ida, Y. 05812

05741 **Szabo, B. J.; Koczy, F. F.; Östlund, G.** Radium and radiocarbon in Caribbean waters: Earth and Planetary Sci. Letters, v. 3, no. 1, p. 51–61, illus., table, 1967.

Measurement of radiocarbon, radium–226, and oxygen indicate that the deep water (>1500 m) of the Colombia and Venezuela Basins are not presently renewed. The renewal time of deep water in these basins is estimated between 50 and 400 years. The radium content is found to be rather uniform in the Venezuela Basin (5.8×10^{-14}g/l); it varied between $4–6\times10^{-14}$g/l in the Colombia Basin. In the Puerto Rico Trench, the radium content was found to increase with depth from 3.4×10^{-14}g/l at the surface to 8.0×10^{-14}g/l at 7400 m depth.—Authors' abstract

05574 **Tabbert, R. L.** Upper Cretaceous pollen and spores from the Ivishak River area, Arctic Alaska [abs.]: Rev. Palaeobotany and Palynology, v. 2, nos. 1–4, p. 8, 1967.

05739 **Tarling, D. H.** The palaeomagnetic properties of some Tertiary lava from East Greenland: Earth and Planetary Sci. Letters, v. 3, no. 1, p. 81–88, illus., tables, 1967.

Tertiary lavas from the Scoresby Sound area of eastern Greenland are found to have moderately stable remanent magnetization which is reversed with respect to the present Earth magnetic field. The mean direction (168,–62) is similar to that of trap diabase dikes in southwestern Greenland. The corresponding pole position is slightly different from those of British igneous rocks in the North Atlantic Province but does not suggest continental drifting between Greenland and Europe since the formation of this igneous province. However, further data from Greenland are required to test this dissimilarity before firm conclusions can be drawn. Author's abstract

05626 **Taylor, Sara Sue; Silberhorn, Gene M.** Effects of aspect on a shale–barren ridge of southwestern Virginia [abs.]: Virginia Jour. Sci., v. 18, no. 4, p. 165–166, 1967.

05556 **Tebbutt, Gordon Edward.** Diagenesis of Pleistocene limestone on Ambergris Cay, British Honduras [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 2002B, 1967.

05769 **Teller, James T.** Glacial geology of Clinton County, Ohio: Ohio Div. Geol. Survey Rept. Inv. 67, 1 sheet, scale 1:62,500, text, 1967.

All of Clinton County has been glaciated; Wisconsin deposits mantle all but the southwestern third where Illinoian drift is at the surface. Underlying bedrock is Ordovician shale and limestone in the southwest and Silurian dolomite in the northeast; except for a large active quarry at Melvin and a few small abandoned quarries near Wilmington, exposures of the Silurian dolomite are rare. Wisconsin outwash in the lower reaches of the Todd Fork drainage is a significant source of sand and gravel and several active pits are located just upstream from Clarksville. Important reserves of ground water are present in the outwash. The rich agricultural soils developed in glacial drift are important also to the economy.—MCM

05686 **Terry, J. P.; Mitchell, R. S.** Observations on pickeringite near Fredericksburg, Virginia [abs.]: Virginia Jour. Sci., v. 18, no. 4, p. 189, 1967.

05966 **Thom, Bruce G.** Coastal and fluvial landforms—Horry and Marion Counties, South Carolina—U.S. Office Naval Research, Geography Br., Proj. Nonr 1575 (03),

Tech. Rept.: Louisiana State Univ. Coastal Studies Inst. Tech. Rept. 44, 75 p., illus., tables, 1967.

Coastal and fluvial deposit sequence reflects five phases of progradation: Horry, Conway, Jaluco, Myrtle, and Recent. During each a surface was built composed of a barrier island behind which backbarrier flat and fluvial sediments accumulated. A sixth surface composed only of fluvial sediments (Terrace I) has been mapped also. Four major transgressions and possibly two minor are indicated. Four major regressions occurred which exposed the Horry, Conway–Jaluco, and Myrtle surfaces to dissection and soil development. The Jaluco surface and Terrace I probably developed during minor regressions–transgressions. Late Cenozoic fluctuations of sea level have lead to a complex pattern of landforms superimposed on this. The older the surface the greater the variation in morphology, and only improved C–14 dating with studies in adjacent areas will show how complete is the Quaternary record.—*from* Author's abstract

Thomas, H. H. *See* Zartman, R. E. 05446

Thompson, G. G. *See* Cross, A. T. 05821

00069 **Thornton, Dewey E.; Gaston, H. H., Jr.** Geology and development at Lusk Strawn field, Eddy and Lea Counties, New Mexico: Am. Assoc. Petroleum Geologists Bull., v. 52, no. 1, p. 66–81, illus., table, 1968.

The Lusk Strawn field is about 30 miles northeast of Carlsbad, N. Mex., on a northwest–trending anticline with more than 650 feet of structural relief. The productive unit, in the Middle Pennsylvanian Strawn Group, is primarily a biostrome at approximately 11,300 feet in depth. The productive rock also includes two local bioherms. The pay unit is vuggy, has intercrystalline porosity, and is extremely fractured. The fractures have been important in the creation of porosity and permeability. To August 1, 1966 the field had produced 12,449,426 bbl of oil and 31,585,786 Mcf of gas from 61 wells draining about 10,400 surface acres. Because Lusk was developed on 160–acre spacing, allowables are high and payout is rapid. The discovery of this field has stimulated deep drilling in the region.—EAM

00103 **Thornton, John E.** Critical evaluation of Hardeman basin and its environs [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 52, no. 1, p. 196, 1968; Shale Shaker, v. 18, no. 5, p. 98–99, 1968.

Tinkle, Donald W. *See* Milstead, William W. 05631

Tippett, M. C. *See* Sayers, R. W. 05712

00112 **Tourtelot, Harry A.** Hydraulic equivalence of grains of quartz and heavier minerals, and implications for the study of placers: U.S. Geol. Survey Prof. Paper 594–F, p. F1–F13, illus., 1968.

Hydraulic equivalence is the concept that describes the relation between grains of a mineral of a given size and specific gravity and the smaller grains of heavier minerals that are deposited simultaneously. Gold spheres from about 0.0003 to about 0.8 mm in diameter are hydraulically equivalent to grains of quartz 0.001 to 8.0 mm in diameter. Diagrams show the hydraulic equivalent sizes for spheres of quartz, magnetite, metallic silver and gold, and the settling velocities of quartz and gold in water and of spheres and flakes of gold in bromoform and diiodomethane.—HAT

05775 **Tozer, D. C.** Towards a theory of thermal convection in the mantle, Chap. 11 *in* The Earth's mantle (T. F. Gaskell, editor): London and New York, Academic Press, p. 325–353, illus., 1967.

This paper proposes a practicable scheme for studying mantle convection problems by fluid dynamic models, and considers some of the consequent theoretical problems. A model with constant internal heat generation and boundary conditions similar to the crust–mantle system suggests that convection is probably confined to the upper

mantle and extends downward from different levels beneath oceanic and continental shield areas. The process of convection places narrow limits on values of viscosity. Model experiments have shown that for layers with internal heat generation the convection cells are much elongated horizontally. The contrast of cell shape for oceanic and continental mantle may account for the rift system being primarily oceanic.—JPF

00119 **Traverse, Alfred; Kolvoord, Roger W.** Utah jet—A vitrinite with aberrant properties: Science, v. 159, no. 3812, p. 302–305, illus., table, 1968.

The gem-grade jet found in Upper Cretaceous rocks of the Jet Basin, Wayne County, Utah, has been shown to be a vitrinitic, high-volatile B bituminous coal with aberrant chemical constitution. The residual structure is entirely that of taxodiaceous conifer wood. The abnormally high volatile content (62 percent) and low reflectance (0.25 percent) of Utah jet compared with other vitrinites of similar rank is produced by the unusual derivatives of cellulose and lignin of which the woody structure is composed.—Authors' abstract

05819 **Traverse, Alfred; Ginsburg, Robert N.** Pollen and associated microfossils in the marine surface sediments of the Great Bahama Bank: Rev. Palaeobotany and Palynology, v. 3, nos. 1–4, p. 243–254, illus., 1967.

Low levels of pine-pollen concentration are found in sandy sediments, and muddy sediments have high concentrations. This is especially true of the area of quiet water west of Eleuthra, where pollen is abundant in the mud in spite of no trees on the island. "Microforaminifera" are more generally distributed; they occur in muddy and in sandy sediments at various locations. Hystrichosphaerids are relatively concentrated in the muddy sediment, as a response to non-turbulence of the water, but they also sediment out to some extent in other locations. They are therefore denser than the pollen. Possible use of palynological analysis in the investigation of paleosediment types and paleohydrological features of sedimentary basins is shown.—*from* Authors' summary

05614 **Trewartha, Glenn T.; Robinson, Arthur H.; Hammond, Edwin H.** Physical elements of geography (5th edition): New York and London, McGraw-Hill Book Co., 527 p., illus., tables, revised 1967; originally published as Elements of geography, by V. C. Finch and G. T. Trewartha, 1936.

In this complete revision, the text has been modernized in content, and chapter outlines, review questions, and the like have been omitted. The name of one original author, Finch, has been dropped since his parts of the book have been so changed that they bear little evidence of his craftsmanship. Parts of the eliminated appendixes are incorporated into the main body of the book, and five plates of the multicolored maps of world distribution are new. The text comprises an introduction (earth maps and mapping), and five sections as follows: elements of climate, climate types and their distribution, land-surface form and the seas, earth resources, and maps.—GDC

Trifunac, M. D. *See* Housner, G. W. 05907

00093 **Trollinger, William V.** Surface evidence of deep structure in Anadarko basin [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 52, no. 1, p. 197–198, 1968; Shale Shaker, v. 18, no. 5, p. 98, 1968.

05933 **Tucker, Delos R.** Faults of south and central Texas [abs.]: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 144–147, illus., 1967.

Tufford, Sarah. *See* Hogberg, R. K. 05809

05770 **Turekian, Karl K.; Harriss, Robert C.; Johnson, David G.** The variations of Si, Cl, Ca, Sr, Ba, Co, and Ag in the Neuse River, North Carolina: Limnology and Oceanography, v. 12, no. 4, p. 702–706, illus., table, 1967.

The Neuse River, relatively free of industrial and municipal contamination, flows over a varied geologic terrain; from weathered crystalline rocks of the Piedmont

it traverses Cretaceous sandstone, shale, and limestone and Tertiary limestones and marls before entering Pamlico Sound. Sampling was done in November, when water sources were more continental than marine. Systematic decreases downstream in Na, Cl, SiO_2 and Ca might be explained by ground-water modification or removal by biologic or inorganic processes. Trace-element concentrations of Sr and Ba have dispersions of about 24 and 33 percent standard deviations, while Co and Ag dispersions are 56 and 49 percent, indicating that for streams the size of the Neuse a single sample of water represents trace-element composition at that time within 25 to 50 percent.—GDC

05779 **Tyree, S. Y., Jr.** The nature of inorganic solute species in water, [Chap.] 8 *in* Equilibrium concepts in natural water systems—Am. Chem. Soc., 151st Ann. Mtg., Pittsburgh, 1966, Div. Water, Air and Waste Chemistry Symposium: Washington, D.C., Am. Chem. Soc. (Adv. Chemistry Ser. 67), p. 183–195, illus., table, 1967.

In the range of pH exhibited by most natural water and in the concentration range greater than millimolar few metal ions exist as simple hydrated cations, and relatively few oxyanions exist as simple monomeric species. The hydrated cations are good buffers toward bases, the metallate ions toward acids. As pH is raised in solutions of many hydrated cations, isopolycations are produced, and ultimately, hydrous metal oxides precipitate. As pH is lowered in solutions of many metallate ions, isopolyanions are produced, and ultimately, hydrous oxides precipitate. Salts of the intermediate isopolyions precipitate in some cases. Where the results are unambiguous, the nature of the intermediate species can be described. Kinetics are thought to have been neglected in studies of such solutions up to the present time.—Author's abstract

05940 **Uchupi, Elazar.** Bathymetry of the Gulf of Mexico, *in* Symposium on the geological history of the Gulf of Mexico, Antillean-Caribbean region: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 161–172, illus., 1967.

There are two provinces in the Gulf Basin, carbonate to the east and terrigenous to the west. The steep, side slopes of the Campeche and Florida Escarpments are due to Cretaceous carbonate precipitation against subsiding continental blocks rather than being fault scarps. After the organisms died, sediment prograding and upbuilding formed the shelf and the smooth, gentle continental upper slope. Seaward progradation buried the algal banks. The continental margin to the west was formed by upbuilding and progradation, altered by salt intrusion. Sigsbee Scarp is the result of the salt intrusion. Diapiric structures extend to the center of the Gulf Basin. Structures in the center are restricted to the eastern margin of the abyssal plain and aligned northeastward. This zone may be a fracture zone.—*from* Author's abstract

00159 **Underwood, Roger.** Geology of the Miami-Picher lead-zinc field, northeastern Oklahoma and southeastern Kansas [abs.]: Oklahoma Geology Notes, v. 28, no. 1, p. 11, 1968.

05765 **U.S. Geological Survey.** National Atlas of the United States—Sheet 126, Productive aquifers and withdrawals from wells: Washington, D.C., U.S. Geol. Survey, scale 1:7,500,000, 1967.

Colored patterns indicate areas underlain by one or more aquifers generally capable of yielding to a well at least 50 gpm of fresh water. Distinction is made between unconsolidated aquifers and consolidated rock aquifers. Withdrawals from wells are represented by two symbols—81,000 acre-feet or 100,000,000 cu. m annually (72 mgd), and half that quantity.—MCM

05445 **Valencia, Mark J.** Recycling of pollen from an air-water interface: Am. Jour. Sci., v. 265, no. 10, p. 843–847, illus., table, 1967.

An experiment was devised to determine whether or not there is an interchange of pollen between a turbulent water surface and the atmosphere. Yields from two experimental environments established the reality of pollen liberation from a water

surface and suggest that salinity may affect the amounts liberated.—Author's abstract

05737 **VanBemmelen, R. W.** The importance of the geonomic dimensions for geodynamic concepts: Earth-Sci. Rev., v. 3, no. 2, p. 79–110, illus., 1967.

An analysis is made of the importance and interrelations of the parameters of length, time, pressure, and temperature, and their bearing upon concepts regarding the Earth's evolution. This leads to a tentative model of the chain of reactions caused by the continuous escape of the endogenic energy from the Earth's interior. Author's summary

05705 **Vandale, August E.** Subsidence—A real or imaginary problem?: Mining Eng., v. 19, no. 9, p. 86–88, illus., 1967.

Subsidence caused by coal mining in Pennsylvania has affected overlying areas where residential housing is rapidly expanding. Homeowners in affected areas can sign an agreement with the coal mining companies to leave sufficient coal in place to prevent subsidence on their properties. The coal support area for a given dwelling is in the shape of a truncated pyramid and is based on a rock fracture of 75° (from horizontal) projected, after providing a 15-ft-wide safety area around the foundation, outward and downward to the coal seam from all four sides of the house foundation. In most cases 50 percent of solid coal in place is considered sufficient to support the structure. Over a ten year period incidence of home damage from mining has been about 2 percent where this support arrangement has been used.—MAC

05650 **VanHorn, Richard.** Anatomy of a cave-in: Intermtn. Contractor, v. 18, no. 40, p. 44, 46, illus., 1967; reprinted, Utah Geol. and Mineralog. Survey Quart. Rev., v. 1, no. 14, p. 1–2, 1967.

The causes of a cave-in of an 11-ft deep trench in northeastern Salt Lake City, Utah, are related to man's disruption of the natural arrangement of alluvial and lacustrine sediments deposited near the high shore of ancient Lake Bonneville. The sediments were used in constructing an uncontrolled fill for a new subdivision. Several years later the fill was excavated and used for backfill around a house. The backfill caved-in shortly after a deep steep-walled trench was excavated into it. The greater porosity resulting from reworking of the natural sediments probably contributed to failure. Soil tests showed the backfill contained 16 percent water whereas the adjacent fill contained only 5 percent.—*from* Author's abstract

00125 **VanSickle, Dianne H.** Fish, *in* Biostratigraphy of the Phosphoria, Park City, and Shedhorn Formations: U.S. Geol. Survey Prof. Paper 313-D, p. 591, 629, table, 1968.

Fish remains, mostly fragmentary and nonarticulated, with teeth predominating, are present in all members of the Permian "Phosphoria rock complex" in western U.S., but certain kinds seem to be more characteristic of certain members. Preliminary identifications and distribution of fish remains in Wyoming are given in a table; material from Idaho, Montana, and Utah was not examined in detail.—VMJ

05863 **Vecchioli, John; Nichols, William D.; Nemickas, Bronius.** Results of the second phase of the drought-disaster test-drilling program near Morristown, N. J.: New Jersey Div. Water Policy and Supply Water Resources Circ. 17, 23 p., illus., tables, 1967.

An additional undeveloped ground-water supply of 2.5 mgd located and added to that found during the first phase, gives an aggregate supply of 10 mgd available from glacio-fluvial sand and gravel in the glacial Lake Passaic region. Water is potable without treatment except for manganese in concentrations up to four times the recommended maximum in East Hanover Township. Knowledge has been gained concerning sand and gravel aquifers, and in addition to areas capable of future development, has delineated areas of meager supply and of heavy pumping favorable for artificial recharge. If water use continues to expand, it will become

necessary to import water from distant sources, develop surface reservoirs in the Passaic River basin, or undertake reuse of existing supplies.—*from* Authors' abstract

05824 **Veeh, H. Herbert.** Deposition of uranium from the ocean: Earth and Planetary Sci. Letters, v. 3, no. 2, p. 145–150, illus., 1967.

Anaerobic sediments from the upper continental slope in the eastern Pacific, the Gulf of California, and a Norwegian fjord have been analyzed for their total U content and the U-234/U-238 ratio by alpha-spectrometry. The U contents range from 4.8 to 39 ppm and are higher than the average of 3 ppm of deep sea clay, stream sediments, and soils. The ratios approach the sea water value of 1.15 in samples with high U content. The U is thus being removed from sea water under certain conditions. The effect of Pleistocene sea-level fluctuations is diminished by the occurrence of extensive areas of uranium deposition below 200 m and by the very long residence time of U in the ocean.—*from* Author's abstract

05758 **Veevers, J. J.** Combined analysis of size, shape, and compositional mode of grains in altered sandstones: Jour. Sed. Petrology, v. 37, no. 4, p. 1251, 1967.

Counts and measurements are made rapidly and simultaneously from thin sections. Data are recorded on a form from which cards are punched for use in a computer program to calculate modal composition, statistical measures of the grain-size distribution, and grain shape.—RAC

00056 **Vice, Raymond B.; Ferguson, George E.; Guy, Harold P.** Erosion from suburban highway construction: Am. Soc. Civil Engineers Proc., v. 94, paper 5742, Jour. Hydraulics Div., no. HY 1, p. 347–348, table, 1968.

Erosion and transportation of sediment by streamflow was studied from 1961–64 in the drainage basin of Scott Run, a tributary to the Potomac River, in Fairfax County, Va.; about 11 percent of the 4.54 sq mi area was disturbed by highway construction. Sediment yield from 88 storm events was calculated; an average of 179 acres of construction area contributed 94 percent of the 37,000 tons transported from the basin during the 3.4 yr period. Comparison of particle composition of parent materials with sediment transported past the gaging station suggests that gross erosion in areas of construction was at least twice the 34,700 tons measured by the gage. Precipitation during the study was about 13 percent less than average; estimated gross erosion under normal precipitation would be about 139 tons per acre per year, more than 10 times that expected from cultivated land and more than 500 times that expected from low yield pasture and forest areas.—VMJ

Volk, V. V. *See* Roth, C. B. 05842

05793 **VonHerzen, R. P.** Surface heat flow and some implications for the mantle, Chap. 9 *in* The Earth's mantle (T. F. Gaskell, editor): London and New York, Academic Press, p. 197–230, illus., tables, 1967.

Steady flow of heat through the Earth's surface may provide more pertinent information about thermal state and production of energy in the interior than other indirect physical measurements. Differences in magnitude of heat flow between low and high anomalous regions imply temperature differences of several hundred degrees C at depths of a few hundred kilometers. Relative contributions of various possible sources to Earth's internal heat are uncertain, although radioactive decay in rocks is probably the dominant source. Mechanisms of heat transfer in the mantle indicate effective thermal conductivity probably increases with depth, though temperature distribution becomes progressively more uncertain with depth. The mantle is largely solid everywhere, but existence of volcanoes in many localities throughout geologic time indicates local melting of mantle material, possibly in response to such a fundamental mechanism as convection.—JPF

Wahl, F. M. *See* Marks, J. W. 05669

05747 **Walker, Roger G.** Upper flow regime bed forms in turbidites of the Hatch Formation, Devonian of New York State: Jour. Sed. Petrology, v. 37, no. 4, p. 1052–1058, illus., tables, 1967.

An upper surface of a bed in a turbidite unit forms broad symmetrical undulations which grade upward into flat parallel-laminated strata. The structures are named "short-crested antidunes" and are interpreted as longitudinal flow features located in the upper flow regime of the turbidite unit. The interpreted current velocity is estimated to have been 1.5 to 2 meters per second.—RAC

05748 **Walker, Roger G.; Sutton, Robert G.** Quantitative analysis of turbidites in the Upper Devonian Sonyea Group, New York: Jour. Sed. Petrology, v. 37, no. 4, p. 1012–1022, illus., tables, 1967.

The Rock Stream Member of the Cashaqua Formation contains turbidites which are flat-lying and structurally undisturbed with west-northwest oriented sole markings. Compared with the decreasing ABC index of Walker (1967), bed thickness decreases exponentially, but parallel lamination and cross-lamination increase. The index does not decrease in a downstream direction. The turbidite beds are interpreted as discontinuous along the length of the basin forming a series of imbricated wedges which were built outward from the source into the basin. Reworking by northwestward flowing ocean currents is suggested.—RAC

05564 **Wall, David; Dale, Barrie.** The resting cysts of modern marine dinoflagellates and their palaeontological significance: Rev. Palaeobotany and Palynology, v. 2, nos. 1–4, p. 349–354, illus., table, 1967.

The study of the cysts of *Gonyaulax, Protoceratium, Peridinium, Diplopsalis,* and *Diplopsalopsis* and 25 species show that they are identical with or phylogenetically closely related to certain Tertiary and Quaternary hystricospheres and fossil dinoflagellates. Problems are discussed, such as the development or absence of an inner capsule, the genotypic value of the dinoflagellate "species" and their cysts, and how they can be classified.—*from* Authors' summary

05716 **Wallace, S. R.; MacKenzie, W. B.; Blair, R. G.** Preliminary report on the geology of the molybdenite deposits at Red Mountain, Dailey Mining District, Colorado [abs.]: Mining Eng., v. 19, no. 12, p. 40–41, 1967.

05687 **Waller, J. O.** Calculations relating to the often-cited basalt-granite differentiation series [abs.]: Virginia Jour. Sci., v. 18, no. 4, p. 189, 1967.

00080 **Walsh, J. B.** Mechanics of strike-slip faulting with friction: Jour. Geophys. Research, v. 73, no. 2, p. 761–776, illus., 1968.

Strike-slip is analyzed for long shallow surface faults on which motion is opposed by a frictional shear stress increasing linearly with depth. Surface displacements and strains are found and the change in elastic potential energy, the frictional dissipation, and the radiated seismic energy are estimated by static elastic analysis. Faults deepening under constant applied stress and under increasing stress also are considered. Energies, displacements, and strains depend markedly on type of faulting. The ratio of hanging wall displacement to that of foot wall is an indicator of dip angle, independent of the type of faulting. Friction increases fault depths calculated in the usual way from surface displacements and strains. Surface strains are more diagnostic of changes occurring on the fault than surface displacements.—*from* Author's abstract

05801 **Wang, Chi-yuen.** Phase transitions in rocks under shock compression: Earth and Planetary Sci. Letters, v. 3, no. 2, p. 107–113, illus., tables, 1967.

The zero-pressure densities of some rock Hugoniots in their high pressure phases are determined. Comparison of these with experimental results on phase transitions of a number of minerals suggests that the predominant transition in Stillwater and Bushveld bronzite is pyroxene→spinel+stipoverite (stishovite). Experimental results on the olivine→spinel transition predict a density too low for the shocked Twin Sisters dunite. The postulate of Birch explains very well the density increase associated with shock-induced transitions in the Twin Sisters dunite and tke zero-pressure density of Westerly granite shocked above 400 kb. Except for the Twin Sisters dunite, none of the shocked rocks has zero-pressure density comparable to that of the lower mantle.—*from* Author's abstract

05557 **Wantland, Kenneth Franklin.** Recent benthonic foraminifera of the British Honduras shelf [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 2002B, 1967.

Warman, J. C. *See* Joiner, T. J. 00040

Wasserburg, G. J. *See* Bogard, D. D. 05814

05636 **Waters, Joseph H.** Fish remains from southern New England archeological sites: Copeia 1967, no. 1, p. 244–245, illus., table, 1967.

Fish skeletal materials representing 16 species were studied from seven archeological sites, which also contained marine mollusk shells, near the coasts of Connecticut and southern Massachusetts and on islands south of Cape Cod. Strata in the sites have been dated by radiocarbon or by European artifacts, and range in age from less than 400 to more than 4,100 years. Every fish species still occurs near the site where its remains were found; there is no evidence that either climatic change or rising sea level has essentially affected the range of any of these species off the southern New England coast during the past 4,200 years.—VMJ

Watkins, N. D. *See* Baksi, A. K. 05975

05936 **Watson, Richard L.** Is there a longshore drift convergence on central Padre Island, Texas? [abs.]: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 150, 1967.

05897 **Weaver, Charles E.** Potassium, illite and the ocean: Geochim. et Cosmochim. Acta, v. 31, no. 11, p. 2181–2196, illus., table, 1967.

Clay minerals are presently adsorbing from the ocean more Na^+ and Mg^{2+} than K^+. Younger sediments have relatively more Na^+ and montmorillonite and less K and illite than older sediments. This change occurs near the end of the Paleozoic and appears to be worldwide. The change is believed due to an increase in the Na, and perhaps Mg, content of the oceans. Montmorillonite, rather than illite, was formed in the Cenozoic and Mesozoic oceans. Much of the Paleozoic and Precambrian illite was formed on the land. Considerably less K, in solution, has been cycled through the ocean than has been assumed. Since the late Paleozoic a major portion of the K removed from the ocean has been in the interstitial waters trapped in marine muds. Only after deep burial is this K fixed in the illite lattice.—*from* Author's abstract

05652 **Webber, H. J.** The oil sands of Alberta: Jour. Canadian Petroleum Technology, v. 6, no. 4, p. 146–149, illus., table, 1967.

The heavy hydrocarbon deposits in the Cold Lake area of Alberta are described, and some observations on other Alberta oil sands, particularly the Athabasca deposit, are presented.—Author's abstract

05916 **Weber, Jon N.** Possible changes in the isotopic composition of the oceanic and atmospheric carbon reservoir over geologic time: Geochim. et Cosmochim. Acta, v. 31, no. 12, p. 2343–2351, illus., tables, 1967.

Carbon isotope ratio analyses of 326 limestones and fossils ranging in age from Precambrian to Quaternary suggest small but possibly real variations in the carbon isotopic composition of the active exchange carbon reservoir throughout geologic time. Variation of C-13/C-12 ratios in freshwater limestones with time may be correlated with the geologic evidence concerning the development and distribution of land plants.—Author's abstract

05694 **Weitzman, Stanley H.** The origin of the stomiatoid fishes with comments on the classification of salmoniform fishes: Copeia 1967, no. 3, p. 507–540, illus., 1967.

The origin and relationships of the salmoniform suborder Stomiatoidei (classification system of P. H. Greenwood, 1966) has long been in doubt. Comparative osteology of a large series of Recent stomiatoid species shows that several gonostomatid genera, especially *Vinciguerria and Polymetme*, are relatively primitive.

Phylogenetically important similarities are found between the osteology of these genera and of the Osmeridae; the osmerids are therefore removed from the Salmonoidei and placed in their own salmoniform suborder Osmeroidei, which is also closely related to the Galaxioidei. Literature on fossil fishes thought by various authors to be related to stomiatoids is reviewed. Of the fossils, only *Paravinciguerria praecursor* Arambourg, Upper Cretaceous of northern Africa, may be near the ancestor of the osmerids and primitive stomiatoids.—VMJ

05442 **Wells, Herbert C.** Tectonic model table suitable for research or instruction: Jour. Geol. Education, v. 15, no. 5, p. 197–198, illus., 1967.

Any sturdy, thick, wood-topped table can be inexpensively converted into a triaxial test device for simple model experiments and classroom demonstration, that can be used with clay or other materials to produce surface structural features of many types. The device designed at Nevada Southern University is patterned after Harmon (1949). The basic mechanical parts, three hydraulic rams, can be obtained from automobile salvage yards; a by-pass for some of the hydraulic fluid will reduce the ram speed and provide variable stress on the three axes. The principal disadvantage is the lack of precise control features.—GDC

05717 **Wells, J. D.; Erickson, Ralph; Stoiser, Lee R.** Geology and mineralogy of the Cortez gold deposit, Nevada [abs.]: Mining Eng., v. 19, no. 12, p. 40, 1967.

05891 **Westphal, W. H.; Lange, A. L.** Local seismic monitoring—Fairview Peak area, Nevada: Seismol. Soc. America Bull., v. 57, no. 6, p. 1279–1298, illus., tables, 1967.

Four portable seismographs were used in January–February and April to August 1965 to record local earthquakes in the Fairview Peak area of west-central Nevada. During these recording periods, which totalled 129 days, over 1,300 local shocks were recorded of which 224 were large enough for determination of focal points. These hypocenters defined the active faults of the region and provided a means for mapping the probable extent of these faults at depth.—Authors' abstract

Westrum, Edgar F., Jr. *See* Holm, J. L. 05921

00077 **Wetherill, G. W.; Williams, J. G.** Evaluation of the Apollo asteroids as sources of stone meteorites: Jour. Geophys. Research, v. 73, no. 2, p. 635–648, illus., tables, 1968.

A quantitative study of the hypothesis that chondritic meteorites are produced as collision fragments of the earth-crossing (Apollo) asteroids indicates difficulties that must be overcome before it can be considered plausible. It is shown that in a steady state, long exposure ages should predominate, if they are ordinary asteroids, and that the expected mass yield of meteorites from the known Apollo asteroids is too small by a factor of about 500. The differences are partly avoidable if the Apollo asteroids are cometary ones.—DBV

00110 **Wetherill, G. W.** Stone meteorites—Time of fall and origin: Science, v. 159, no. 3810, p. 79–82, illus., 1968.

The fact that twice as many chondritic meteorites are observed falling in the afternoon as in the morning is not believed to be primarily of social origin, but to be a dynamic effect. Monte Carlo calculations show that the observed afternoon excess is not compatible with a lunar or Apollo asteroidal origin. Compatibility appears to require a source having an aphelion near Jupiter, such as could be provided conceivably by the Hilda or Trojan families of asteroids, or by short-period comets.—Author's abstract

05630 **Weyl, Richard.** Ozeanische Kruste im südlichen Mittelamerika?: Umschau, v. 67, no. 12, p. 392, illus., 1967.

Cretaceous magmatic rocks in the Santa Elena and Nicoya Peninsulas, Costa Rica, are considered of oceanic crustal or upper mantle origin. They are interpreted as evidence that the region was an oceanic zone during the Upper Cretaceous and

was converted into a continental zone during Tertiary orogenic activity.—GSA Bib. Staff

05667 **White, George W.** Accounts of Illinois geology by John Bradbury in 1817: Illinois Acad. Sci. Trans., v. 60, no. 4, p. 337–339, 1967.

John Bradbury (1765–1823), an English botanist well skilled in mineralogy and geology, traveled in Illinois in 1809, 1810, and 1811. The important geological observations made in Illinois and included in his report of 1817 have never been recorded and deserve attention. He recognized the flat-lying strata of limestone, shale, sandstone and coal and asserted they had been deposited after a long period of time and had not been affected by later "convulsions." His description of Illinois fluorspar is probably the earliest known.—Author's abstract

Whiteside, Melbourne C. *See* Cole, Gerald A. 05743

Whiting, L. L. *See* Stevenson, D. L. 05870

05914 **Whittaker, E. J. W.** Factors affecting element ratios in the crystallization of minerals: Geochim. et Cosmochim. Acta, v. 31, no. 12, p. 2275–2288, illus., tables, 1967.

Further criticisms of the geochemical rules and principles proposed by Goldschmidt, Ringwood, and Ahrens are advanced, and reasons are sought as to why the rules often seem to hold, in spite of their weak theoretical foundation. These reasons stem in part from the effects of element abundances, and in part from thermodynamic considerations. The thermodynamic approach to the problem suggested by McIntire and by Burns and Fyfe is modified into a form that is more amenable to consideration from an atomistic and structural point of view. It is pointed out that an atomistic approach to the problem requires as much information on the effects of liquid structure as on those of crystal structure, and the Bernal liquid model is suggested as a useful approximation in some problems involving the crystallization of liquid silicates.—*from* Author's abstract

05893 **Wideman, C. J.; Major, M. W.** Strain steps associated with earthquakes: Seismol. Soc. America Bull., v. 57, no. 6, p. 1429–1444, illus., tables, 1967.

Strain steps have been observed following earthquakes of magnitude 3.0 to 8.5. An empirical relationship is derived indicating the magnitude of the smallest earthquake from which a strain step of the order of 10^{-9} may be expected at a given distance. Comparison with the empirical equation relating fault length to magnitude shows that strains of the order of 10^{-9} may be expected at a distance of about 20 fault lengths. Strain steps are shown to have two characteristics which are similar to those of surface waves. The speed of propagation is nearly constant over a wide range of epicentral distances: for continental paths, 3.0 ± 0.3 kmps and for oceanic, near 3.6 kmps.—DBV

05696 **Wiggins, L. B.; Horne, K. C., Jr.** Mineralogy of the old pyrite mine near Proffit, Albemarle County, Virginia [abs.]: Virginia Jour. Sci., v. 18, no. 4, p. 189, 1967.

05561 **Wildman, William Edwards.** Serpentinite weathering and clay mineral formation in some California soils [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 2056B, 1967.

00054 **Wilkinson, W. D.; Oles, Keith F.** Stratigraphy and paleoenvironments of Cretaceous rocks, Mitchell quadrangle, Oregon: Am. Assoc. Petroleum Geologists Bull., v. 52, no. 1, p. 129–161, illus., tables, 1968.

About 9,000 feet of Albian and possibly Cenomanian-age rocks are exposed in a 70-sq-mi area within the southern half of the Mitchell quadrangle. The exposure area is cut by the east-trending Mitchell fault; maximum right-lateral displacement is 12,000 feet; the north side is up, and stratigraphic displacement near Mitchell is about 4,000 feet. The Cretaceous sequence rests unconformably upon Permian phyllites and crystalline limestone. Coarser clastics of fluvial-deltaic origin (the Gable Creek Formation) from the north intertongue with marine mudstone,

siltstone, and sandstone (the Hudspeth Formation). Paleogeographic analyses indicate a rising landmass on the north and a shallow marine embayment south, during Albian time. Measured sections (totaling 9,000 feet) are described in detail, as also are sedimentary structures.—BHK

05451 **Williams, Charles H., Jr.** George County geology and mineral resources: Mississippi Geol. Econ. and Topog. Survey Bull. 108, p. 1–152, illus., tables, geol. map, 1967.

George County, in southeastern Georgia, has rocks of Miocene, Pleistocene, and Recent age exposed at the surface. The units in ascending order are the Miocene Pascagoula Formation, the Pleistocene Citronelle Formation, Big Terraces and Low Terrace deposits, and Recent alluvium. The major structural features are the east–west trending Wiggins anticline, a relative young feature, and an anticline in the eastern part of the county. The county has good quality ground water in aquifers of the Catahoula, Pascagoula, Hattiesburg and Citronelle Formations, and in the alluvium and Low Terrace deposits. Rocks and minerals of economic importance include clays, natural clay mixtures, sand, and gravel. Oil, gas, and sulfur are potential resources.—MST

05475 **Williams, George A.; Holstein, H. J.** Geology of southeastern Idaho central phosphate region, *in* Anatomy of the western phosphate field—Intermountain Assoc. Geologists, 15th Ann. Field Conf. 1967: Salt Lake City, Utah, Intermountain Assoc. Geologists, p. 45–59, illus., table, 1967.

A general description of the stratigraphic section of the sedimentary rocks (Mississippian–Quaternary) of the central phosphate region is given, and a generalized section of the Meade Peak Member of the Phosphoria Formation is illustrated. The highly complex structure of the region is described and the economic aspects of the central phosphate region are outlined. The phosphate is concentrated in the Meade Peak Member. The complex folding of the region plays an important role in determining mining techniques.—KAS

05555 **Williams, George A.** The Phosphoria Formation—Idaho summary, *in* Industrial seminar, western phosphate region, 1966, Proc.: Montana Bur. Mines and Geology Spec. Pub. 42, p. 13–17, 1967.

This is an address, summarizing the history of the phosphate industry in Idaho, a general description of mineral economics, with emphasis upon phosphate, and finally a cursory description of the Permian Phosphoria Formation in Idaho. No new details are included.—HRC

Williams, H. H. *See* Billings, Gale K. 05898

Williams, J. G. *See* Wetherill, G. W. 00077

Williams, Jacob L. *See* Coester, B. B. 00100

Williams, James Steele. *See* McKelvey, V. E. 05473

05665 **Williams, John W.** Joint patterns as indicators of regional tilting in southern Piedmont [abs.]: Virginia Jour. Sci., v. 18, no. 4, p. 189, 1967.

05558 **Williams, Paul Lincoln.** Stratigraphy and petrography of the Quichapa Group, southwestern Utah and southeastern Nevada [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 28, no. 5, p. 2003B, 1967.

00076 **Williams, R. C.** Sediment in streams, *in* Water resources of King County, Washington: U.S. Geol. Survey Water-Supply Paper 1852, p. 48–52, illus., 1968.

The amount of sediment transported by streams in King County is small in relation to the large amount of runoff from the area. Large suspended sediment concentrations are closely associated with seasonal high streamflow; mean daily values of discharge for Green River near Palmer ranged from a trace to 49,000 tons per day during 1953–57, with an even greater range in instantaneous values.

Data for the Green River basin upstream from Palmer show annual suspended-sediment yield ranging from 28 to 543 tons per sq mi. Particle-size distribution of suspended sediment varies from one stream to another and from time to time in the same stream. Significant amounts of sand, gravel, and coarser material are transported as stream bedload during high-water periods.—MCM

Willis, W. O. *See* Benz, L. C. 00141

Willoughby, Donald R. *See* Parkin, Alan K. 00128

05797 **Wilson, J. Tuzo.** Theories of building of continents, Chap. 14 *in* The Earth's mantle (T. F. Gaskell, editor): London and New York, Academic Press, p. 445-473, illus., tables, 1967.

Hypotheses of continental growth are discussed with respect to present knowledge of the Earth, and particularly of its continental and oceanic crust. Convection currents that move at a rate of a few cm/yr in the low velocity layer of the mantle provide the most plausible growth mechanism. Continents form part of the rigid layer above the convection currents. A process is outlined whereby continents spread laterally, nourished by twice-cycled differentiates from the mantle. Continents appear to have grown progressively by uplift from below, and by accretion at their margins.—JPF

05836 **Wilson, James Lee.** Carbonate-evaporite cycles in lower Duperow Formation of Williston basin: Bull. Canadian Petroleum Geology, v. 15, no. 3, p. 230-312, illus., tables, 1967.

The biostratigraphy and petrography of three depositional cycles in the lower part of the Duperow Formation of early Late Devonian (Frasnian) age were studied Each cycle consists of a basal dark-brown brachiopod-crinoid limestone or stromatoporoid biostrome, a medial brown ostracode-calcisphere lime mudstone interbedded with unfossiliferous pelletoid beds or lime mudstone, and a capping anhydrite interbedded with grayish-green silty dolomite. Deposition of the remarkably persistent thin beds that constitute these cycles occurred within a vast backreef lagoon lying south of the Woodbend reef platform in southern Alberta. Slow, steady subsidence accompanied by climatic fluctuations may have caused the cyclic deposition. Most replacement dolomitization occurred prior to complete lithification, but in post-Duperow Devonian time.—CAS

00161 **Wilson, L. R.** Paleoecology of Pennsylvanian coal swamps in Oklahoma [abs.]: Oklahoma Geology Notes, v. 28, no. 1, p. 10, 1968.

05653 **Wilson, Leonard G.** The origins of Charles Lyell's uniformitarianism, *in* Uniformity and simplicity—A symposium on the principle of the uniformity of nature: Geol. Soc. America Spec. Paper 89, p. 35-62, illus., 1967.

The author discusses the influence of the intellectual climate of the time upon the origins of Charles Lyell's principle of Uniformitarianism, as well as the influence of the concept of Uniformitarianism upon scientists and laymen of the mid nineteenth century. The acceptance or rejection of Lyell's ideas as well as others by various scholars was in part determined by political considerations.—MST

00050 **Wisecarver, David W.** Changes in stress, strain and displacement with change in slope angle at the Kimberly Pit [abs.]: Mining Eng., v. 20, no. 1, p. 91, 1968.

Witherspoon, P. A. *See* Neuman, Shlomo P. 00153

00137 **Withrow, Jon R.** Geology of the Cromwell Sand Member in the Franks Graben area, Coal and Pontotoc Counties, Oklahoma: Shale Shaker, v. 18, no. 5, p. 82-96, illus., tables, 1968.

The Pennsylvanian Union Valley Formation, consisting of the Cromwell Sand and overlying limestones, is bounded conformably by the underlying Springer and overlying Wapanucka Formations. The Cromwell, averaging 125 feet in thickness, is divisible into two glauconitic sand bodies, both of which produce oil and gas.

Sand–shale ratios increase gradually from south to north. Principal structure in the area is the Franks graben. During the Wichita orogeny, the area was uplifted, and later, in the Arbuckle orogeny, fault structures formed. History of the oil-field development is reviewed. The Fitts field had produced 121,246,000 bbl of oil by Jan. 1, 1967, from seven horizons, and the Jesse field, 12,850,000. Cromwell Sand has produced in six of the eleven fields in the area. Cross sections, isopach and structure maps, and a block diagram are included.—ESL

05756 **Wobber, Frank J.** The orientation of *Donax* on an Atlantic coast beach: Jour. Sed. Petrology, v. 37, no. 4, p. 1233–1235, illus., 1967.

Studies conducted along the North Carolina coast indicate that the valves of *Donax* show a preferred orientation nearly perpendicular to the existing shoreline. The morphological relatives of this bivalve in Mesozoic and Tertiary sediments could prove to be useful bio-directional indicators in local paleogeographic reconstruction.—*from* Author's abstract

Wollin, Goesta. *See* Ericson, David B. 05643

Woncik, John. *See* Dolloff, J. H. 05899

05889 **Wones, David R.** A low pressure investigation of the stability of phlogopite: Geochim. et Cosmochim. Acta, v. 31, no. 11, p. 2248–2253, illus., tables, 1967.

Phlogopite reacts to form orthorhombic kalsilite, leucite, forsterite and fluid (H_2O) at 1012±7°C, 400 bars pressure, and 905±5°C at 100 bars pressure. The heat of reaction is 39±4 kcal compared to 44±5 kcal for the reaction of annite to form orthorhombic kalsilite, leucite, fayalite and fluid (H_2O). The results are consistent with earlier experiments, but not with the interpretations of those experiments.—Author's abstract

05964 **Wood, John A.** Criticism of paper by H. E. Suess and H. Wänke, "Metamorphosis and equilibration in chondrites" [1967]: Jour. Geophys. Research, v. 72, no. 24, p. 6379–6383, 1967.

Suess and Wänke (ibid., v. 72, no. 14, p. 3609–3612, 1967) have advanced three arguments, based on noble gas spectrometry of chondrites, against the concept of chemical equilibration during metamorphism. Two of these arguments are shown to be irrelevant. The third is discussed in more detail and shown to be erroneous. The answer to an apparent conflict of data, which would render both Suess and Wänke's third objection and Wood's response to it of academic interest only, is believed to lie in the "Xe–129 retention" temperature, which is not known.—DBV

Woodyer, K. D. *See* McGilchrist, C. A. 00138

00068 **Worthington, Joseph E.** Changing tools for the geologist, *in* What should be the long-range R and D mission for the mineral industries?: Mining Eng., v. 20, no. 1, p. 54–56, 1968.

Exploration and field geologists by the 1980's will find increasing uses for photogeologic techniques using color film, infrared and radar imagery, and other more sophisticated types of remote sensors. Mobility and speed in the field will be improved through the use of helicopters or some more futuristic craft. New types of portable equipment designed for direct outcrop examinations should permit more rapid gathering of field data. Field studies will be fundamental to all other studies in the future as in the past. The role of the geologist in our increasingly more urbanized society will become more important. Computers will be widely used to help solve geologic problems. Many advances will be made in geochemistry and geophysics which will assist the geologist in his studies.—MAC

05718 **Wright, Phillip M.** Determining variations in the thickness of recent cover with gravity [abs.]: Mining Eng., v. 19, no. 12, p. 30, 1967.

05699 **Wrucke, Chester T.; Armbrustmacher, Theodore J.** Geochemical anomalies in the vicinity of Gold Acres and Tenabo, Lander County, north central Nevada [abs.]: Mining Eng., v. 19, no. 12, p. 37, 1967.

05939 **Yarborough, Hunter.** Geologic history of the Gulf Basin [abs.], *in* Symposium on the geological history of the Gulf of Mexico, Antillean-Caribbean region: Gulf Coast Assoc. Geol. Socs. Trans., v. 17, p. 160, 1967.

00160 **Yeck, Ronald D.; Fenton, Gray.** Preliminary studies of opaline phytoliths from selected Oklahoma soils [abs.]: Oklahoma Geology Notes, v. 28, no. 1, p. 10-11, 1968.

00126 **Yochelson, Ellis L.** Biostratigraphy of the Phosphoria, Park City, and Shedhorn Formations: U.S. Geol. Survey Prof. Paper 313-D, p. 571-660, illus., tables, 1968.

The fauna of the Permian "Phosphoria rock complex" in Montana, Idaho, Wyoming, and Utah, is dominated by mollusks, brachiopods, and bryozoans; the last group is common only in areas of limestone deposition. Other fossils are exceedingly rare or absent. The fauna in limestones of the Park City Formation is suggestive of shallow to extremely shallow water, mollusks predominating in a shoreward facies. Sandstones of the Shedhorn are virtually lacking in fossils and may have been beach deposits. Phosphatic shales of the Phosphoria Formation suggest deposition in moderately shallow water, possibly no more than several hundred feet deep, but a soft bottom and perhaps a paucity of oxygen limited the fauna. Associated cherts contain virtually nothing but sponge spicules; interbedded limestone lenses contain a fauna similar to shoreward-deposited limestones. The rock complex is probably of Leonard to Word age.—ELY

05854 **Yochelson, Ellis L.; Saunders, Burnett W.** A bibliographic index of North American late Paleozoic Hyolitha, Amphineura, Scaphopoda, and Gastropoda: U.S. Geol. Survey Bull. 1210, 271 p., 1967.

This work is an index of specific names used in four classes of Mollusca in the Mississippian, Pennsylvanian, and Permian of North America. Pertinent references in an 1898 index by Weller are reprinted. The index is comprehensive to December 31, 1966.—ELY

York, D. *See* Baksi, A. K. 05975

05666 **Young, Robert S.** Reconsideration of the Shenandoah Valley sulfide district, Virginia [abs.]: Virginia Jour. Sci., v. 18, no. 4, p. 190, 1967.

00111 **Ypma, Peter J. M.** Pyrite group—An unusual member, $Cu_{0.60}Ni_{0.14}Co_{0.03}Fe_{0.23}S_2$: Science, v. 159, no. 3811, p. 194, illus., 1968

An investigation of villamaninite from the type locality indicates that former analyses were of aggregates rather than of individual minerals. A redefinition embraces a larger range of solid solution, the end-member of which has the highest content of copper so far attributed to a member of the pyrite family.—Author's abstract

Zaitseff, J. B. *See* Cross, A. T. 05821

05570 **Zaklinskaya, E. D.** Palynological studies on Late Cretaceous-Palaeogene floral history and stratigraphy: Rev. Palaeobotany and Palynology, v. 2, nos. 1-4, p. 141-146, illus., 1967.

According to palynological data, the last fundamental rearrangement of the flora and its complete renovation took place at the Late Cretaceous-Paleogene boundary. The early Paleogene flora was differentiated into three floristic areas, but the dominating taxa in each of the areas are different from those in Maastrichtian times. By the end of the Paleogene, changes in climate zones caused rearrangements within the floristic areas and a degradation of the polychronous floras of the northern hemisphere. Therefore, Oligocene palyno-stratotypes are mainly local.—*from* Author's summary

05446 **Zartman, R. E.; Brock, M. R.; Heyl, A. V.; Thomas, H. H.** K–Ar and Rb–Sr ages of some alkalic intrusive rocks from central and eastern United States: Am. Jour. Sci., v. 265, no. 10, p. 848–870, illus., tables, 1967.

Small intrusive alkalic rock bodies in the central and eastern interior United States range in composition from syenite to peridotite, and have K–Ar and Rb–Sr ages that range from Late Ordovician to Late Cretaceous. Many of the intrusions are on a structural lineament along the 38th parallel from Kansas to West Virginia. Several distinct periods of intrusion are indicated.

05447 **Zen, E-An.** Some topological relationships in multisystems of n+3 phases—[Pt.] 2, Unary and binary metastable sequences: Am. Jour. Sci., v. 265, no. 10, p. 871–897, illus., 1967.

When a univariant equilibrium obtains in a n–component, n+3 phase multisystem, only two extra phases remain. In a free energy–composition plot, these two phases may lie above, below, or astride the line that depicts the n+1 phases in univariant equilibrium. Therefore, each univariant line in a n+3 phase multisystem exists at 3 levels of stability. Each univariant line forms a complete loop on the p–T diagram. Because the univariant lines can cross indifferently in only specifiable ways, the geometric relations of the various univariant loops on the p–T plane can be predicted. From these relations the sequences of metastable phase assemblages for specified p, T, and bulk compositions can be predicted.—*from* Author's abstract

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